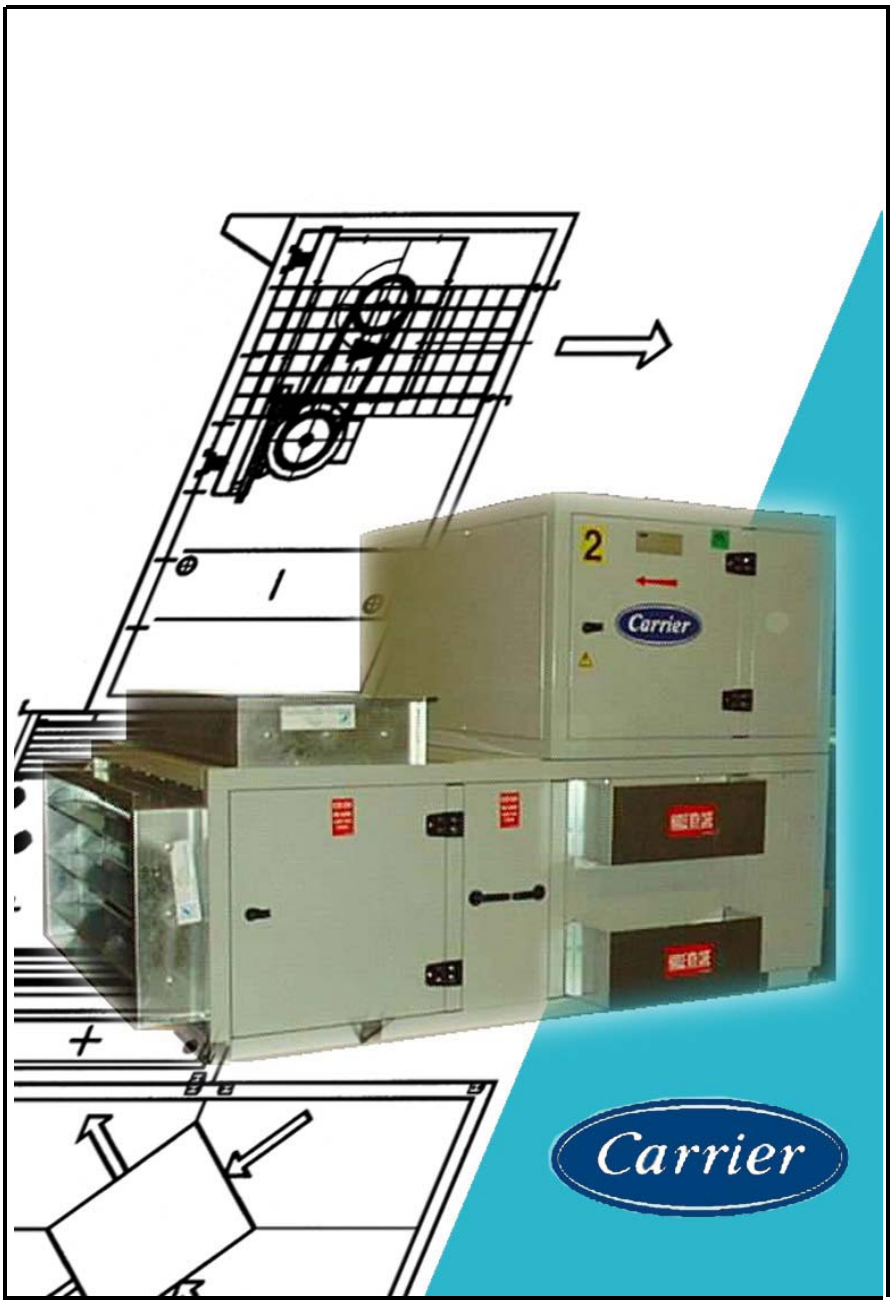
Product Data

# 39FD/FX Central Station Air Handling Units

Nominal 1000 $m^3$/hr to 160,000 $m^3$/h




## Features/Benefits

- **Flexible modular construction offers several configurations of unit height and width to meet installation space requirements**
- **The units are fabricated from heavy gauge galvanized powder painted steel sheet with linear gasket between panels to ensure sturdy construction and excellent leak tight**
- **Units are offered with double skin panels in 25 mm (39FD) or 50mm (39FX) thickness**
- **Fan and motor packages are mounted on common bases with vibration isolators to ensure moving parts are isolated from the casing structure**
- **Units can be delivered in complete or partial sections or knocked-down for on site assembly**
- **Manufactured at an ISO 9001 listed facility to guarantee quality**

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# Table of Contents


| | |
|---|---|
| Introduction | 2 |
| Identification | 3 |
| Quick Selection | 4 |
| Components | 5 |
| Casing | 7 |
| Dimension | 8 |
| Dampers | 9 |
| Filters | 12 |
| Fans | 17 |
| Motor | 22 |
| Drives | 26 |
| Coils | 27 |
| Electric Heaters | 30 |
| Heat Recovering System | 33 |
| Humidifiers | 36 |
| Sound Attenuators | 39 |
| Application Guide | 40 |
| Options | 43 |
| Guide Specifications | 45 |
| Selection Tools and Sample Selection | 51 |
| Conversion Table | 56 |

# Introduction

The purpose of this catalogue is to guide consulting engineers in the **preliminary** selection of *Carrier* Air Handling Units. However, if required, your local *Carrier* office will assist to provide a computerized selection to confirm or complete your preliminary selection.

This catalogue consists of:

- A description of the various component parts available to be combined in the order best suited to your requirements.
- Technical data sheets, dimensions, weights, specifications, charts, etc.
- Component specification and international standard compliance.
- Product features and application.

**QUALITY**

The quality and reliability of any system depends on the quality of the component parts. Therefore, inline with other *Carrier* products our 39F Series Air Handlers are manufactured in conformity with *Carrier*'s Quality concept with vendor items subjected to rigorous inspection. Components installed in Air Handlers are manufactured, tested or rated in compliance to international standards.

**FLEXIBLE MODULAR CONSTRUCTION**

This adaptable unit design which is based upon a wide range of standard panel sizes frequently enables *Carrier* to offer several configurations of unit height and width, so that the aesthetic or practical dictates of confined plant room space or rooftop silhouettes can be easily met.

Major sections of the Air Handling Unit such as fan, coil, filter, etc, can be arranged in the sequence dictated by the job requirements, and separated by access sections where necessary, giving complete flexibility of design.

The units can be delivered in sections for indoor or outdoor installation, completely assembled, partially assembled or knocked-down for on-site assembly.

**RIGID AND LEAKTIGHT CONSTRUCTION**

The *Carrier* series 39F Air Handling Unit is fabricated from heavy gauge galvanized powder painted steel sheet, which is folded to form sturdy side, top and bottom panels and a rigid "Penta Post" supporting frame.

Panels and frame are secured using internally bolted fixings so that welding is minimized and the integrity of the galvanized finish is maintained. Gasket liner between panels and frame ensures excellent leaktight and also as thermal and acoustic insulation. This bolted construction, and the use of standardized components facilitates the removal of panels for maximum access to fans, coils, filters, etc.

**WIDE RANGE OF SIZES**

23 standard sizes provide air quantities from,

- 1000 $m^3$/hr to 78,810 $m^3$/hr – cooling duty
- Up to 90,855 $m^3$/hr – heating only duty

For duties in excess of the above, please contact your *Carrier* office.

**FLEXIBILITY IN PANEL CONSTRUCTION**

Units are offered with double skinin 25 mm (Model 39FD) and 50mm (Model 39FX) thickness.

**VIBRATION ISOLATION**

Centrifugal fan/motor packages are mounted on common bases with rubber or spring vibration isolators and flexible cuffs ensuring that all moving parts are independently isolated from the casing structure.

**AESTHETICS**

The standard construction features galvanized panel and frame finished in light gray polyester powder paint, capable of withstanding 1000 hours of direct salt spray according to ASTM B117.

**ACCESSIBILITY AND MAINTENANCE**

The easily removable panels and quick release access doors offer complete accessibility to fans, coils, filters and dampers. Additional access sections can be provided between coils and filters if required.

All component parts are standard and interchangeable. Filters are commercially available standard items conforming to international standards and sizes.

**INDIVIDUALIZED PRODUCT LINE**

All 23 standard sizes are available as 'Customized' adapted exactly to meet specific job requirements. For example: Non-standard coil materials, variable fan speed control, humidifiers, heaters, attenuators, etc.

# Identification

The 39F line of *Carrier* Air Handling Units is base on Modular system

The number of modules respectively in height and in width determines the cross-section available for airflow and encodes the unit size.

The unit length is determined by the number and size of the component parts required.

The side for services (connections and access) is defined as right hand or left hand in the direction of the airflow.

*Example:*

**39 F D 4 5 0 _ _ _ _ _**

AIR HANDLING UNIT

**F** = MODEL

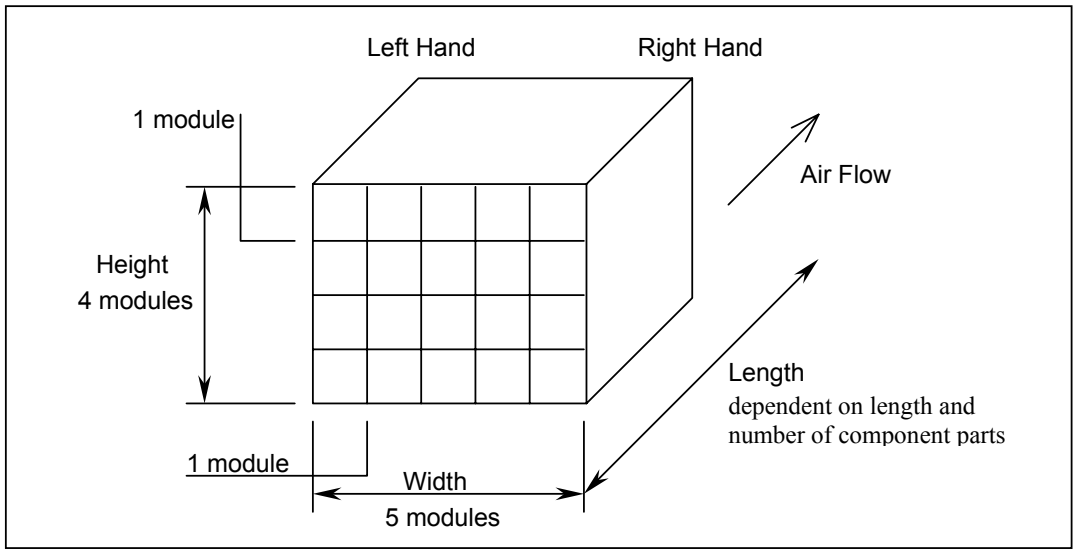
**D** = 25 mm or **X** = 50 mm

HEIGHT in modules

WIDTH in modules

COIL HEADER LOCATION
**0** = internal header
**4** = external header with header box

UNIT SERIAL NUMBER



# Quick Selection

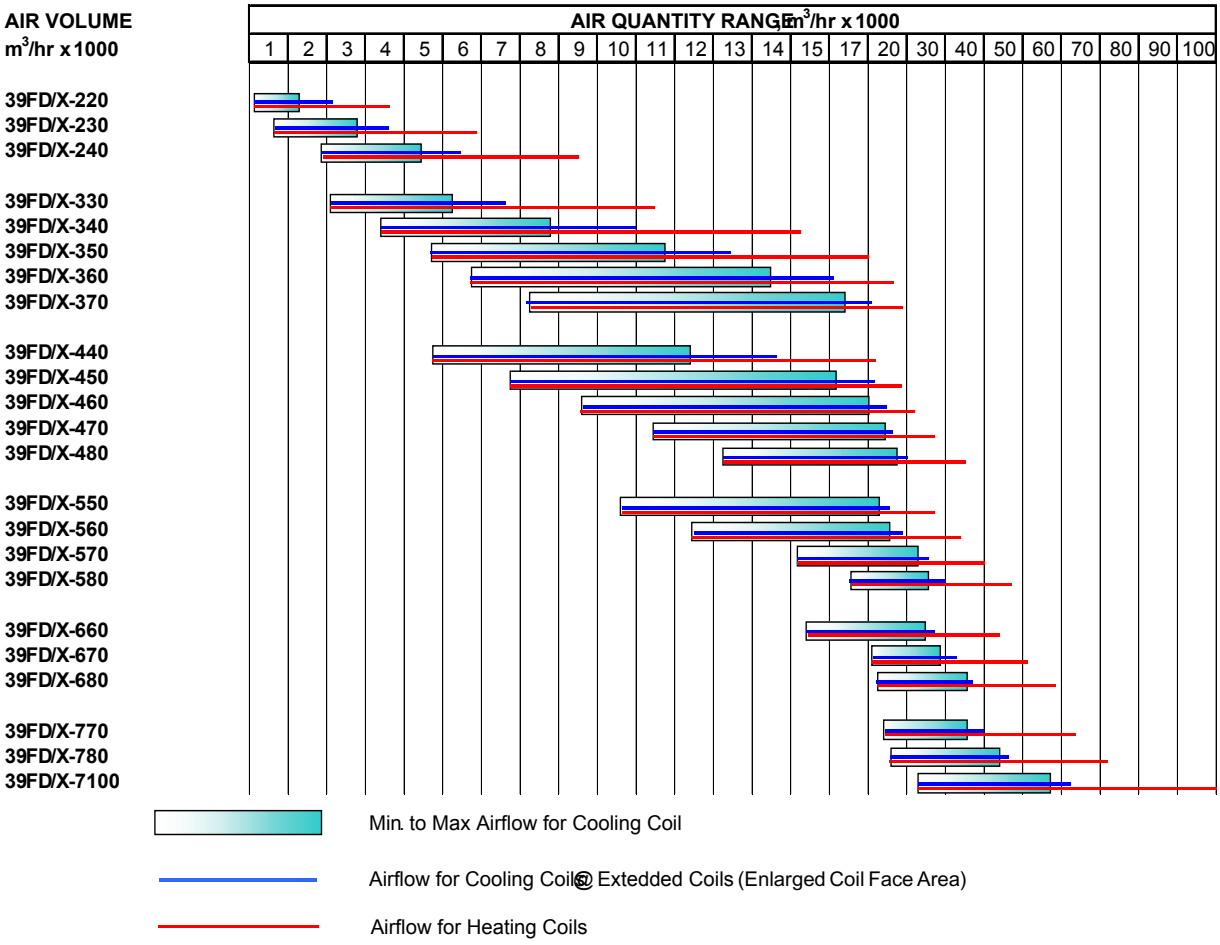
The air volume entering the finned coil section determines the unit size as follows,

1.5 m/s minimum velocity (cooling or heating)

2.6 m/s maximum velocity for cooling coil without droplet eliminator

3.15 m/s maximum velocity for cooling coil with droplet eliminator

4.5 m/s maximum velocity for heating coil




*Example:*

To determine the size of a unit delivering 30000 $m^3$/hr of air (unit supplied with cooling and heating coil), two selections are possible,

- size 570 (standard unit) with droplet eliminator, coil section 2.77$m^2$ face area

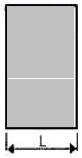
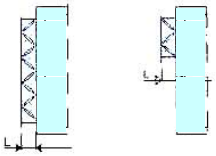
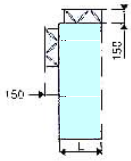
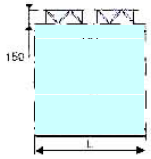
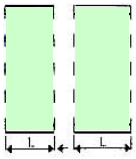
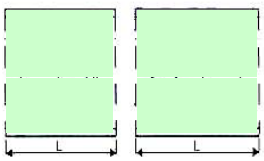
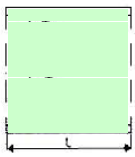
$\frac{30000}{3600 \times 2.77}$ = 3.0 m/s (max 3.15 m/s)

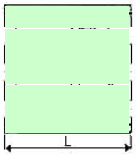
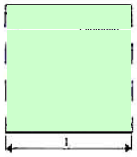
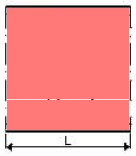
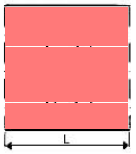
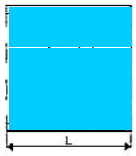
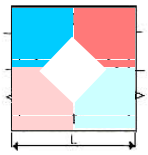
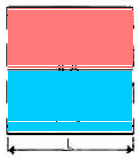
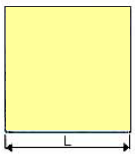
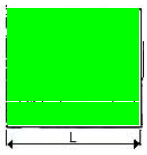
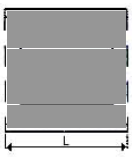
- size 580 (customized unit) without droplet eliminator, coil section 3.26$m^2$ face area

$\frac{30000}{3600 \times 3.26}$ = 2.55 m/s (max 3.15 m/s)

**LIST OF COMPONENTS AND THEIR CASING LENGTH**

Airflow from left to right

| Component | Legend | Symbol | Length in Module M |
|---|---|---|---|
| Empty box | **CV** | | L = n x M<br>L max = 10 M |
| Door | **PO** |  | L = 580 mm<br>combined in 2 M |
| Damper on outside of case :<br>full face<br>half face | **RA**<br>**RM** |  | L = 150 mm<br>External protrusion from case |
| Box with one damper | **RI** | | L = 1 module |
| Mixing box<br>with two dampers | **RD** |  | Unit size: L =<br>220 to 480 2 M<br>550 to 680 3 M<br>770 to 7100 4 M |
| Combination mixing box<br>with three dampers | **RT** |  | Unit size: L =<br>220 to 480 4 M<br>550 to 680 6 M<br>770 to 7100 8 M |
| Side withdrawal filters :<br>metallic flat<br>synthetic flat<br>vee filter | **FM**<br>**FI**<br>**FV** |  | L = 1 M<br>With side panel for quick access |
| Front or back withdrawal filters :<br>metallic filters<br>synthetic flat<br>vee filter | **FM**<br>**FI**<br>**FV** |  | L = 2 M<br>with access door upstream or downstream<br>L = 0 if filters are built into mixing box |
| Soft bag filter<br>Rigid bag filter | **FP**<br>**FR** |  | L = 2 M with access via mix box<br>3 M with downstream access<br>4 M with upstream access |

| Component | Legend | Symbol | Length in Module M |
|---|---|---|---|
| Roll filter | **FD** |  | L = 2 M with access via mix box<br>3 M with upstream access |
| Absolute filter<br>or<br>carbon filter | **FA**<br><br>**FC** |  | L = 2 M with access via mix box<br>3 M with upstream access |
| Hot water coil | **BC** |  | 1 to 4 rows L = 1 M<br>5 to 8 rows L = 2M |
| Electric heating coil | **BE** |  | L = 1 M |
| Cooling coil | **BF** |  | L = 2 M |
| Plate recouperator | **ES**<br>**EH**<br>**EP** |  | L = 3 to 8 M<br>See section on heat recovery |
| Run around heat<br>Recovery coils | **EB** |  | L = 2 M<br>2 sections required |
| Humidifier<br>1 or 2 spray tree(s) | **HU** |  | 1 spray tree L = 4 M<br>2 spray trees L = 6 M |
| Supply or<br>exhaust fan | **VS**<br>**VE** |  | L = See section for fans |
| Sound attenuator | **SL** |  | L = 3 – 4 – 5 or 6 M<br>See section on sound attenuator |

# Casing

## GENERAL

The 39F casings comes with double skin features and consist of penta post frame, fixed and removable panels, and internal insulation. The casing constructions are designed with air-tightness, thermal and acoustical insulated features. The sturdy construction of panels reinforced with solid polyurethane insulation and frames are from galvanized, minimized spangle (G90) and are aesthetically finished with 50 micron light gray powder paint. The casing or section arrangements are flexible depends on the requirements.

### Frame

The frame is made up of 3 components,

- penta post frame
- corner piece
- intermediate post

1. Penta post frame
   Forms the overall shape of the section and receives the panels. The penta post is manufactured from press formed, galvanized steel sheet, externally painted and internally insulated with styrofoam of 32 kg/m$^3$ density.
2. Corner piece
   Completes corner section by connecting penta post in three planes. Manufactured from galvanized steel sheet, press formed, welded and externally painted.
3. Intermediate post
   Recessed to accept panels and stiffens the case assembly. Made of galvanized steel sheet, press formed to a top hat shape, externally painted and internally insulated.

### Panels

Two types of panels,

- fixed panel
- access panel

1. Fixed panel
   Form the insulated enclosure of the case and give it rigidity and air-tightness, they consist of,
   - external sheet metal (outer skin)
   - insulation
   - internal protective cover (inner skin)
   - gasket liner

   All panels come in *double-skin* configuration. The external galvanized sheet metal 24 gauge thickness is painted. The pre-painted internal protective cover over the integrated polyurethane insulation comes with galvanized 24 gauge to form solid and sturdy panel.
2. Access panel
   Constructed in similar manner as fixed panel with similar material and dimension. Three types are available,
   - *Removable panel* – fixed to frame with external screws for easy service access and it comes as standard at coil section, heater section and fan section.
   - *Quick removable panel* – access panel secured to frames by latches for quick lift-off release and easy removable at filter section.
   - *Hinged door* – equipped with either latch or lock type to facilitate the maintenance and service at fan section or mixing box.
3. Paint
   Oven-baked gray polyester powder, 50 microns thick provides an excellent weather protection. Tested at different condition for gloss, adhesion, impact resistance, over-baked resistance and salt spray resistance in compliance to ASTM B117.

### Insulation

All panels are with thermal and acoustical insulated that compliance with NFPA 90 A & B.

Panels come with 30-50 kg/m$^3$ density range for polyurethane insulation as standard.

Frames are insulated with 32 kg/m$^3$ density styrofoam.

### Sectioning Casing

Sectioning casing will be determined by selection software and it can be modified according to actual used. For special casing configuration, please contact your nearest *Carrier* office.

### Recommendations

For expose external installation a weatherproof roof plus a base frame must be provided. Protective inlet and discharge hoods are available as options.

Units are suitable for operation in external ambient temperatures of –30°C to +80°C.

Back

# Dimensions

**GENERAL**

The physical size and internal dimensions of the Air Handling Unit is determined by the number of modules. Each module has a constant value of 315mm. Module dimensions are the same for both 39FD and 39FX series but the external dimensions will be different due to different panel thickness.

The length of the unit is found from the sum of component part (in modules) required.

*Example*:

Consider unit 39FD360 with 8 modules long,

Height = (3 x 315 mm) + (2 x 25 mm) = 995 mm

Width = (6 x 315 mm) + (2 x 25 mm) = 1940 mm

Length = (8 x 315 mm) + (2 x 25 mm) = 2570 mm

In the case of 39FX series, replace 25 mm with 50 mm.

**OVERALL DIMENSIONS**

| Unit size | Number of modules | | | 39FD box (mm)* | | |
|---|---|---|---|---|---|---|
| | Height (H) | Width (W) | Max section Length (L)** | Height (H) | Width (W) | Max section Length (L)** |
| **220** | 2 | 2 | 10 | 680 | 680 | 3200 |
| **230** | 2 | 3 | 10 | 680 | 995 | 3200 |
| **240** | 2 | 4 | 10 | 680 | 1310 | 3200 |
| **330** | 3 | 3 | 10 | 995 | 995 | 3200 |
| **340** | 3 | 4 | 10 | 995 | 1310 | 3200 |
| **350** | 3 | 5 | 10 | 995 | 1625 | 3200 |
| **360** | 3 | 6 | 10 | 995 | 1940 | 3200 |
| **370** | 3 | 7 | 10 | 995 | 2255 | 3200 |
| **440** | 4 | 4 | 10 | 1310 | 1310 | 3200 |
| **450** | 4 | 5 | 10 | 1310 | 1625 | 3200 |
| **460** | 4 | 6 | 10 | 1310 | 1940 | 3200 |
| **470** | 4 | 7 | 10 | 1310 | 2255 | 3200 |
| **480** | 4 | 8 | 7 | 1310 | 2570 | 2255 |
| **550** | 5 | 5 | 10 | 1625 | 1625 | 3200 |
| **560** | 5 | 6 | 10 | 1625 | 1940 | 3200 |
| **570** | 5 | 7 | 10 | 1625 | 2255 | 3200 |
| **580** | 5 | 8 | 7 | 1625 | 2570 | 2255 |
| **660** | 6 | 6 | 10 | 1940 | 1940 | 3200 |
| **670** | 6 | 7 | 10 | 1940 | 2255 | 3200 |
| **680** | 6 | 8 | 7 | 1940 | 2570 | 2255 |
| **770** | 7 | 7 | 10 | 2255 | 2255 | 3200 |
| **780** | 7 | 8 | 7 | 2255 | 2570 | 2255 |
| **7100** | 7 | 10 | 7 | 2255 | 3200 | 2255 |

** For 39FX units add 50mm to H, W and L*

*** Max length for any one section. No limit to the total number of sections used*

****Dimensions do not include dampers, connections, extended coil, accessories and others.*

# Dampers

## GENERAL

### Functions

1. Antifreeze (for minimal leakage)
2. Two-way or three-way mixing
3. Bypass
4. Multizone

### Features

- Standard construction flange case frame from 1.5 mm galvanized steel sheet at both side.
- Less resistance sintered bronze (oilite) bushing and self lubricating bearings means free of maintenance.
- Oppose blades with single skin and laminar profile blade design provide low resistance to airflow. Parallel blade offered as option.
- Fitted with close gap between case and blades and with lip formed seal between damper blades and back seat seal which provide low leakage, Class IV according to UL555S.
- Low sound level and low air pressure losses with of hollow aerodynamic profile damper blades.
- Low torque requirement and precise control with external spindle, side linkage and oppose blade operation.
- Non-welded damper blades made of GI material ensures corrosion resistant

## CONSTRUCTION

Steel frame, flanged but not drilled, from galvanized sheet steel.

Blades are galvanized sheet steel of single skin and laminar profile, designed to prevent twisting.

Wider blades are reinforced to ensure stronger blades at higher face velocity and minimized air leakage.

Shafts are made of 12mm dia, cadmium plated steel.

Bushings are from sintered bronze (oilite) or hard nylon, press-seated into the frame. Blades are interconnected by means of linkage and require low torque, even at high-pressure differential.

Interconnection on fresh, return and exhaust air dampers is made with pushrods that are delivered pre-installed by factory. Accessory actuators act on two or three extended shafts and are selected to match damper torque.

Damper spindle located either left or right hand upon request.

## RECOMMENDATIONS

Limits of application:

- Temperature –30°C to +80°C
- Maximum pressure differential 2000 Pa
- Maximum velocity 9 m/s

## INSTALLATIONS

The dampers are located on the outside of mixing boxes except on external installations where dampers are internally mounted.

U-formed damper frame serves as a flange for ductwork connection.

## DAMPER SIZES

Standard 39F Air Handling Units damper sizes are as attached tables.

## DAMPER TORQUE

Damper Torque, $M_1$ (Nm), can be determined from the following relation,

$M_1 = \alpha \times \Delta P \times A \times 10^{-2}$

Where,

$\alpha$ : Torque coefficient, cm

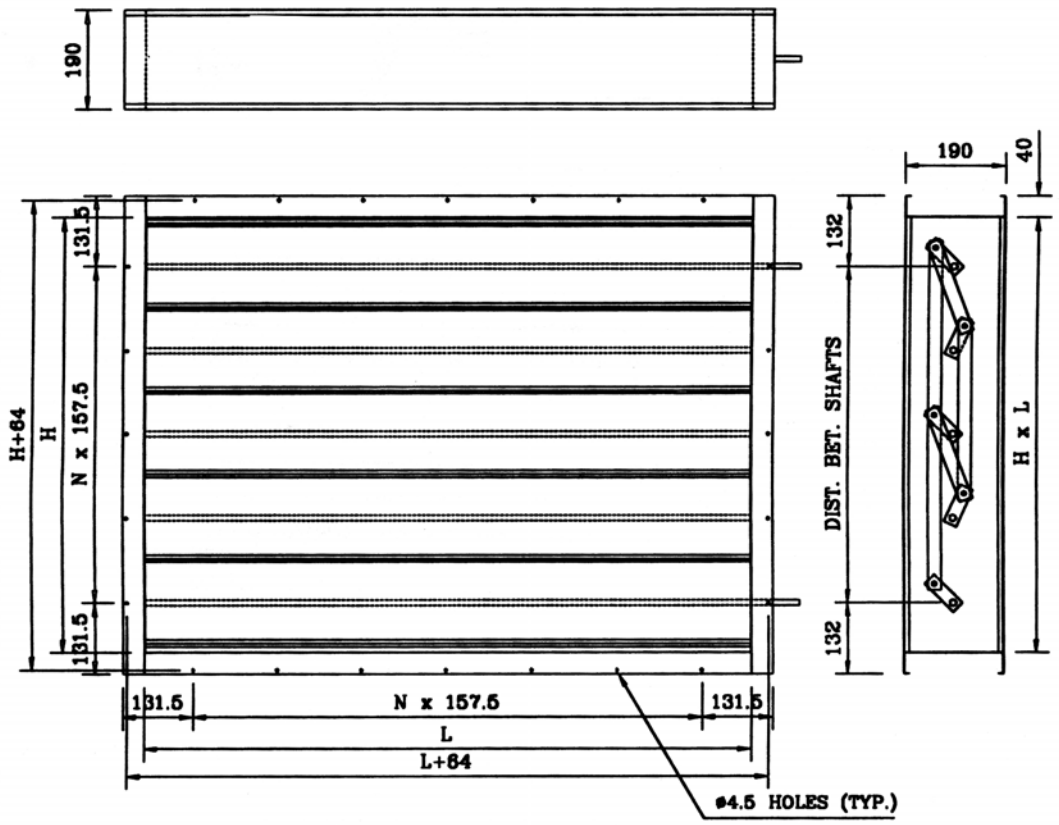
$\Delta P$ : Total pressure drop, Pascal (or $N/m^2$)

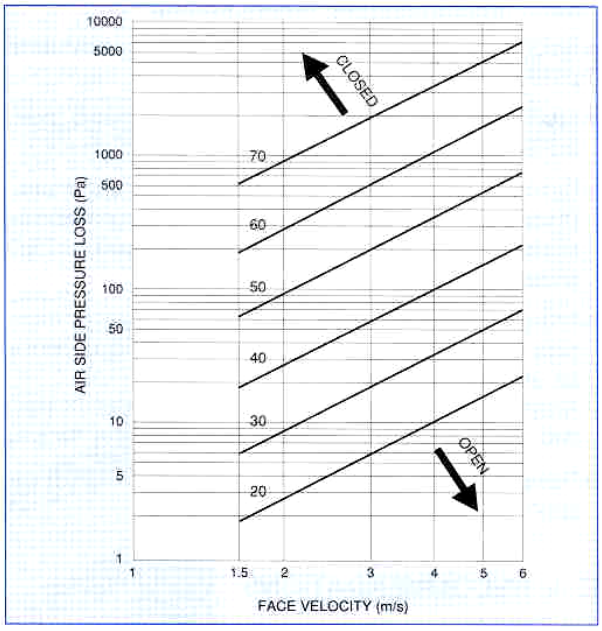
A : Damper cross-sectional area, $m^2$

References for torque coefficient pressure drop and standard damper sizes as per curves and table attached in Page 11.

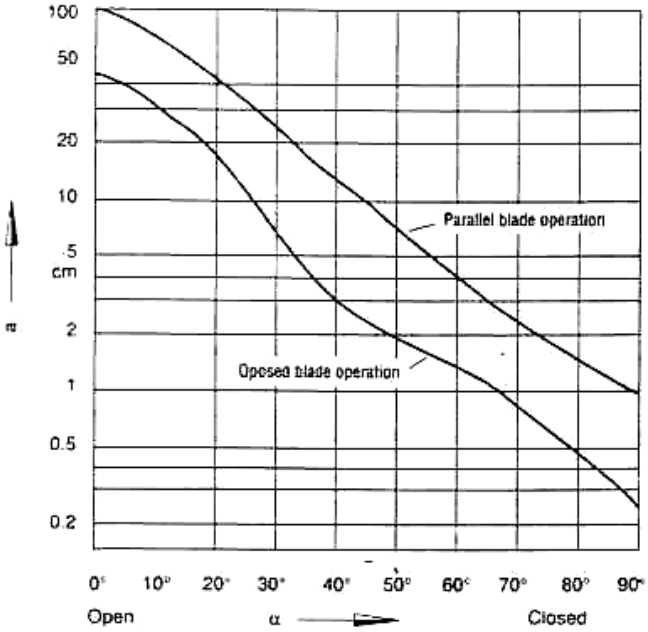
**Standard damper size**

| Height | | | Length (mm) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Module | | | | | | | | | |
| | | (mm) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Module | 1 | 183 | 183 | 498 | 813 | 1128 | 1443 | 1758 | 2073 | 2388 | 2703 | 3018 |
| | 2 | 498 | 183 | 498 | 813 | 1128 | 1443 | 1758 | 2073 | 2388 | 2703 | 3018 |
| | 3 | 813 | 183 | 498 | 813 | 1128 | 1443 | 1758 | 2073 | 2388 | 2703 | 3018 |
| | 4 | 1128 | 183 | 498 | 813 | 1128 | 1443 | 1758 | 2073 | 2388 | 2703 | 3018 |
| | 5 | 1443 | 183 | 498 | 813 | 1128 | 1443 | 1758 | 2073 | 2388 | 2703 | 3018 |
| | 6 | 1758 | 183 | 498 | 813 | 1128 | 1443 | 1758 | 2073 | - | - | - |
| | 7 | 2073 | 183 | 498 | 813 | 1128 | 1443 | 1758 | 2073 | - | - | - |






**Pressure Drop Curve**




**Torque Coefficient Curve**

# Filters

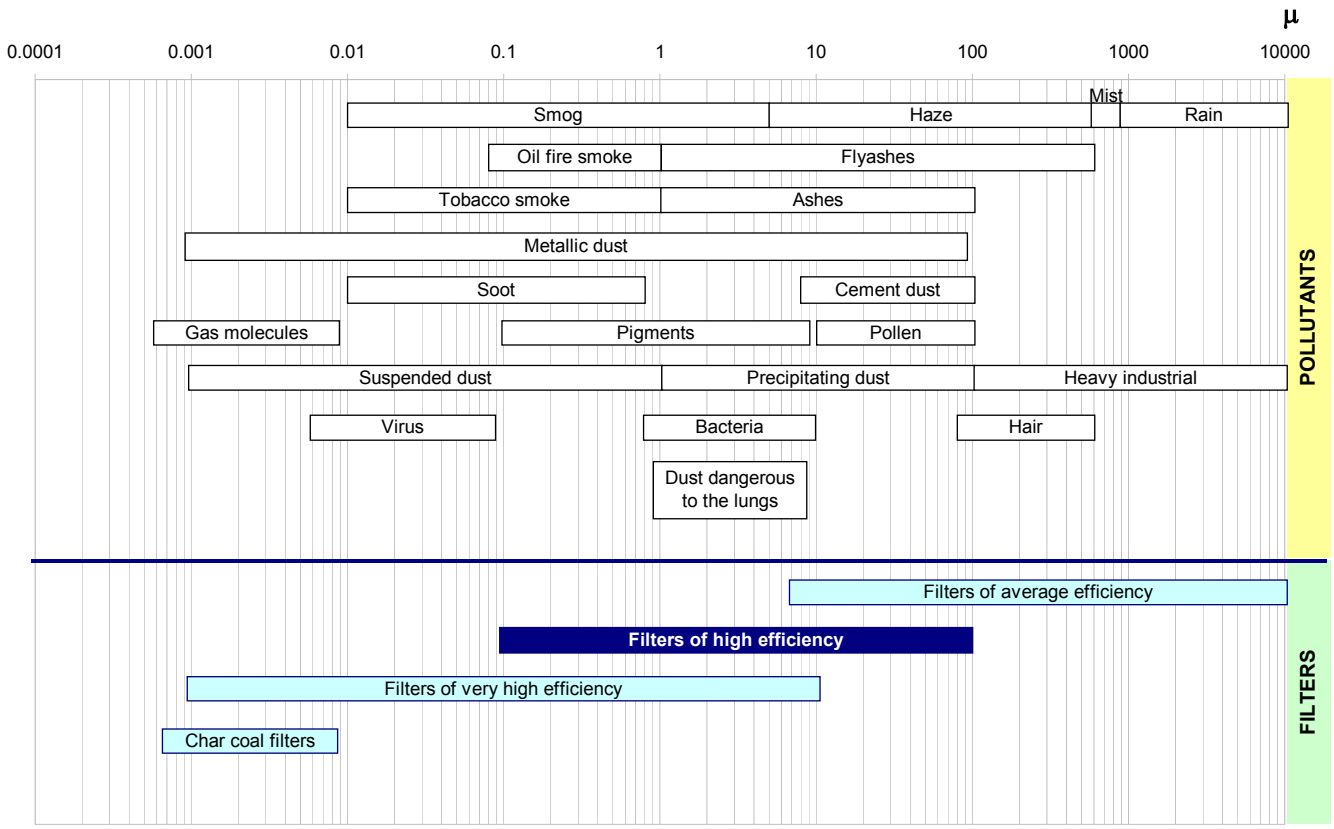
## GENERAL

Recommended filters for 39F Air Handling Unit are tested by AFTL (American Filter Testing Laboratory) as per ASHRAE 52.1-1992 test method for performance, arrestance grade and flame protection. The media is made of synthetic polyester fiber (except for metallic filter media) with no electro-static present, non-flammable, washable and heat resistant up to $100^0$C.

Standard filter type for 39F Air Handling Units are:

- Flat pre-filter – 100% synthetic media, washable, flame retarded, and U.L.Class 2 Rated.
- Metallic – Aluminum media, washable and rust proof.
- V-pleated - 100% synthetic media, washable, flame retarded, and UL Class 2 Rated.
- Soft bag – Synthetic or fiber media, flame retarded, and U.L. Class 2 Rated (from 50% up to 65% Efficiency) and U.L. Class 1 Rated (from 85% up to 95% Efficiency).
- Rigid bag - Synthetic polyester media, flame retarded, and U.L. Class 1 and 2 Rated.
- Absolute – will depend to the application. Please contact *Carrier* office for further information.

It is important to know the type and size of particles in order to select the correct filter type. The chart below illustrates various type of particles and their sizes and some guidance for appropriate filter to be selected.




*Type of particles in microns and recommended filters*

## FILTER CHARACTERISTICS

### Efficiency

The definition of filter efficiency is the capability of the filter to retain particles. The filter efficiency is supplied together with an indication of test method being used or else the definition is meaningless.

$$\text{Efficiency (\%)} = \frac{\text{quantity of retained dust}}{\text{total emitted quantity of dust}} \times 100$$

### Pressure drop

The loss pressure drop through filters is a function of the air velocity and the state of filter saturation. In selecting fans for air handling units, it is recommended that pressure loss through filters is taken as 150% of the pressure loss of clean filters.

### Saturation time

Saturation time is an indication of the capacity of the filter to hold a certain amount of dust during a given time and at a given air velocity. The saturation time depends on the degree of site pollution. This data is essential for establishing life expectancy and preservation of filter efficiency.

## ASHRAE 52.1-92 FILTER TEST METHOD

ASHRAE test method is the procedure by which practically all filter manufacturers describe the filter performance. Eurovent classification of filters established filter categories that based on ASHRAE test method. These categories are:

EU1 = Arrestance less than 65%

EU2 = Arrestance from 65% up to 80%

EU3 = Arrestance from 80% up to 90%

EU4 = Arrestance from 90% or greater

EU5 = Efficiency from 40% up to 70%

EU6 = Efficiency from 60% up to 80%

EU7 = Efficiency from 80% up to 90%

EU8 = Efficiency from 90% up to 95%

EU9 = Efficiency greater than 95%

| Filter | Method of measure | Type of measure |
|---|---|---|
| Average efficiency | Relation to weight | Gravimetric |
| High efficiency | Relation to transparency | Opacimetric |
| Very high efficiency or absolute | Quantity of particles | Counting and DOP |

*Method and type of measure*

## RECOMMENDATION

Filters should always be installed inside the air handling units. Absolute filters should be supplied with a prefilter of an opacimetric efficiency of 80 to 85%.

The amount of dust accumulated should regularly be checked by measuring the pressure drop across the filter and this should not exceed 300 Pa.

The pressure drop on absolute filters should not exceed twice the clean pressure loss. These recommendations refer to normal air contamination in average urban areas. Special solutions must be sought for air contamination created in industrial locations.

Filters exposed to high radiant temperature (above 120°C) such as steam coils, electric resistance heaters or similar, should be protected by inserting a heat rejecting screen between the heat source and the filter (optional feature).

## INSTALLATION

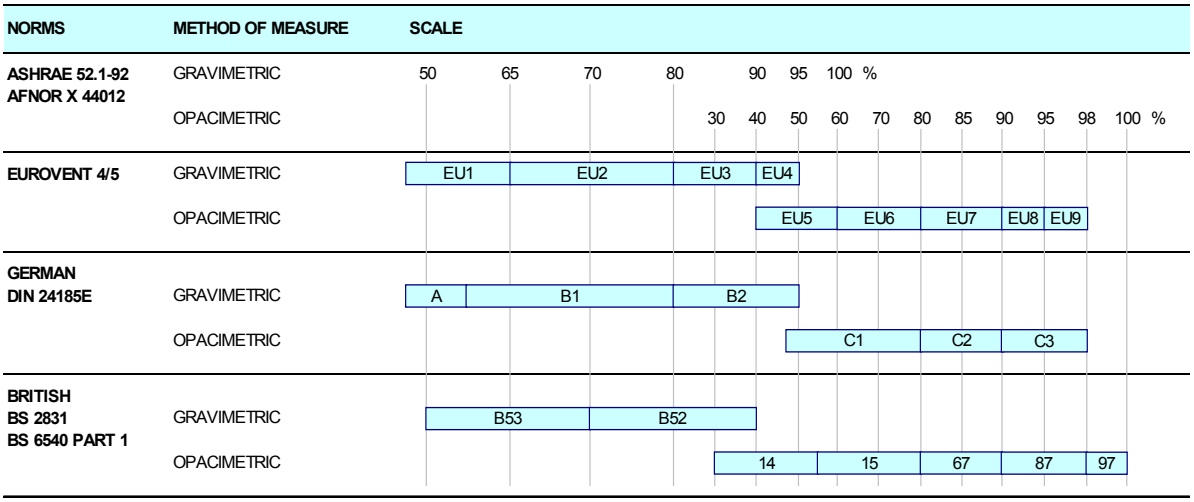
Depending on the type of filter, the following recommendations are made:

1. In slide rails for side withdrawal and filters of average efficiency, such as flat metallic or synthetic filters Synthetic V-shape filters.
2. In frames for front or rear withdrawal for filters of high and very high efficiency
   - Bag filters, soft and rigid
   - Absolute filters
   - Charcoal filters

   The use of prefilters (of average efficiency) is recommended to extend the life of high efficiency filters. These are mounted in frame for front withdrawal.

Automatic roll filters Roll filters are not available for the sizes 220, 230, 240, 330. For detail specification please contact *Carrier* office.

Filter standard comparison.



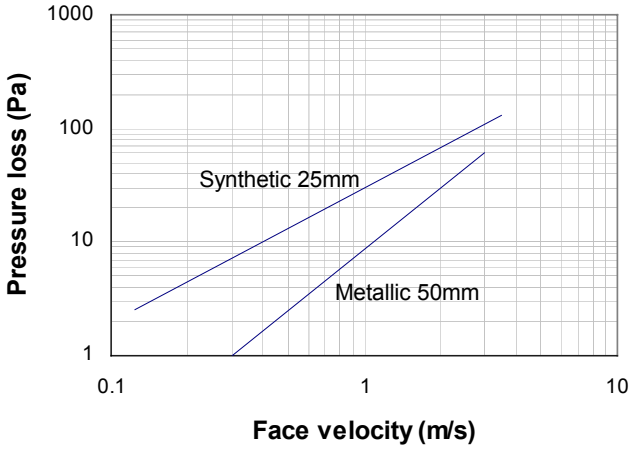

| Degree of Efficiency | Type of Filter | Efficiency | Installation | | Filter Thickness mm | Face Velocity | | Fire Class (ASHRAE 52.1-92) | Utilization Characteristics |
|---|---|---|---|---|---|---|---|---|---|
| | | | Frame | Slide Channel | | Recomm m/s | Max m/s | | |
| Average | Flat metallic | Gravimetric 73% | | x | 25<br>50 | 2.5 | 3.0 | M1 | Washable |
| | Flat synthetic | Gravimetric 85% | x | | 25 | 2.0 | 3.5 | M1 | Prefilter |
| | Roll filter fiber glass | Gravimetric 85% | In special frame | | 50 | 2.5 | 3.2 | M1 | Constant pressure drop |
| | V Shape synthetic | Gravimetric 90 -95% | x | <br>x | 50<br>75 | 2.5<br>2.5 | 3.0<br>3.0 | M1<br>M1 | Good relationship efficiency / space requirement |
| High | Soft bag | Opacimetric<br>50%<br>85%<br>95% | <br>x<br>x<br>x | | <br><br>547 | <br><br>3.5 | <br><br>4.0 | <br><br>M1 | <br><br>Large air quantities |
| | Rigid bag | Opacimetric<br>50%<br>85%<br>95% | <br>x<br>x<br>x | | <br><br>292 | <br><br>2.7 | <br><br>3.2 | <br><br>M1 | <br>Verticle or variable air flow |
| Very High | Absolute | DOP 99.99% | x | | 292 | 2.5 | 2.8 | M1 | Operating rooms or similar |

*Type and characteristics of filter used in 39F units*

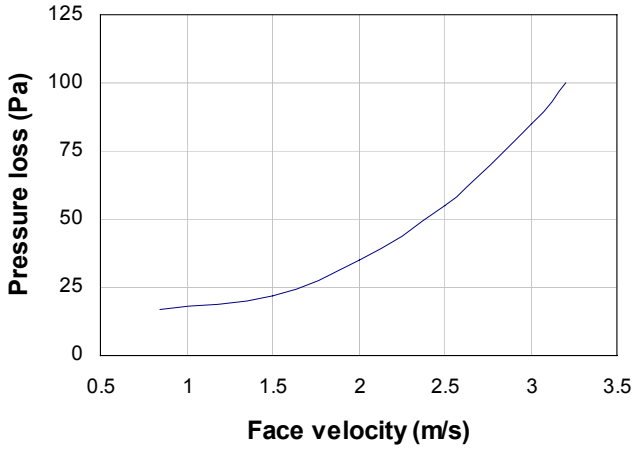
M1 : Non flammable
For special filter, please contact your nearest *Carrier* office.

## Pressure loss (Clean filters)

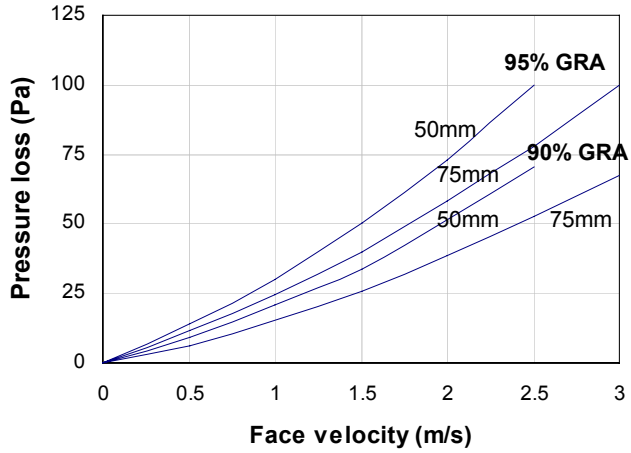
### Flat synthetic fiber and metallic filters



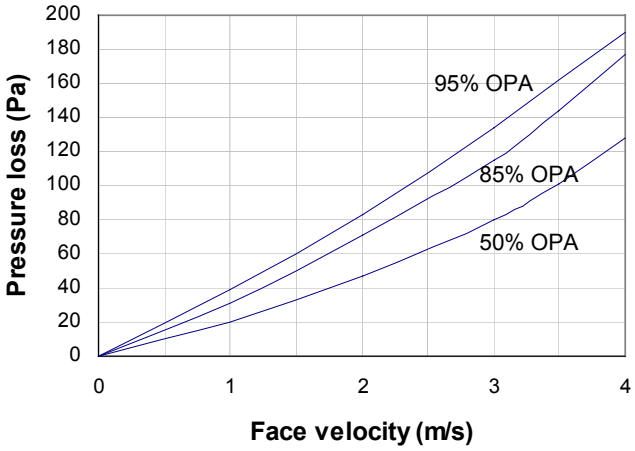

### Rollfilter



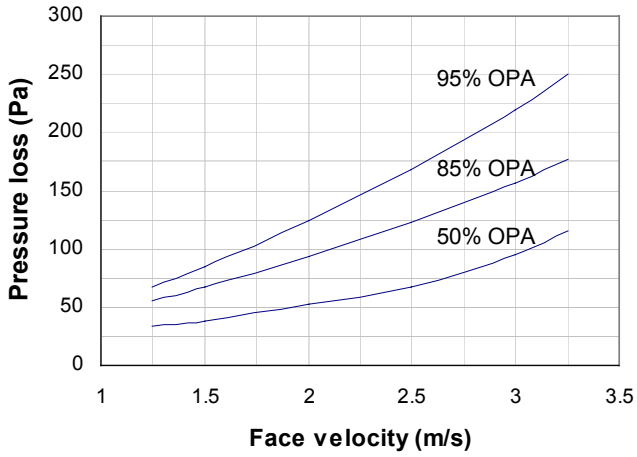

### Pleated filters



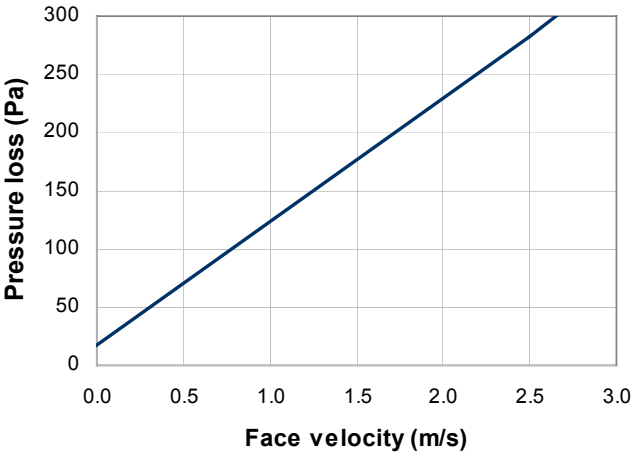

### Soft bag filter




### Rigid bag filter




### Absolute filter



## Weights and dimensions of filters used in 39F units

| Unit size | Pleated 50mm | | Prefilter 25mm | | Bag filter (soft) | | Dimensions (mm) and number of filters | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 39F | l/s max at 2.5 m/s | Weight (kg) | l/s max at 3.5 m/s | Weight (kg) | l/s max at 4 m/s | Weight (kg) | 914 x 610 | 914 x 305 | 610 x 610 | 610 x 305 |
| **220** | 860 | 3 | 4400 | 2 | 5050 | 2 | | | 1 | |
| **230** | 1310 | 4 | 6550 | 3 | 7500 | 4 | | | 1 | 1 |
| **240** | 1740 | 6 | 8850 | 4 | 10100 | 4 | | | 2 | |
| **330** | 1970 | 6 | 9900 | 4 | 11350 | 5 | 1 | 1 | | |
| **340** | 2650 | 9 | 13350 | 6 | 15300 | 8 | 2 | | | |
| **350** | 3130 | 11 | 16600 | 7 | 19000 | 9 | 2 | 1 | | |
| **360** | 3970 | 13 | 20050 | 9 | 22900 | 11 | 3 | | | |
| **370** | 4630 | 15 | 23300 | 10 | 26600 | 13 | 3 | 1 | | |
| **440** | 3500 | 11 | 17650 | 8 | 20200 | 8 | | | 4 | |
| **450** | 4360 | 14 | 21950 | 10 | 25100 | 11 | | | 4 | 2 |
| **460** | 5260 | 17 | 26500 | 11 | 30300 | 12 | | | 6 | |
| **470** | 6110 | 20 | 30800 | 13 | 35150 | 15 | | | 6 | 2 |
| **480** | 7010 | 22 | 35350 | 15 | 40350 | 16 | | | 8 | |
| **550** | 5470 | 18 | 27600 | 12 | 31500 | 15 | 2 | 1 | 2 | 1 |
| **560** | 6610 | 21 | 33300 | 14 | 38050 | 17 | 3 | | 3 | |
| **570** | 7680 | 25 | 38700 | 17 | 44200 | 21 | 3 | 1 | 3 | 1 |
| **580** | 8810 | 28 | 44400 | 19 | 50750 | 33 | 4 | | 4 | |
| **660** | 7890 | 25 | 39750 | 17 | 45400 | 18 | 6 | | | |
| **670** | 9170 | 29 | 46150 | 20 | 52750 | 23 | 6 | 2 | | |
| **680** | 10510 | 34 | 53000 | 23 | 60550 | 24 | 8 | | | |
| **770** | 10720 | 35 | 54050 | 24 | 61800 | 29 | 3 | 1 | 6 | 2 |
| **780** | 12320 | 40 | 62050 | 27 | 70950 | 31 | 4 | | 8 | |
| **7100** | 15390 | 50 | 77600 | 34 | 88650 | 39 | 5 | | 10 | |

**Filters 50mm pleated, 25mm prefilters, soft bag filters in frames**

| Unit size | Absolute | | Bag filters (rigid) | | Dimensions (mm) and number of filters | |
|---|---|---|---|---|---|---|
| 39F | l/s max at 2.8m/s | Weight (kg) | l/s max at 3.2 m/s | Weight (kg) | 610 x 610 | 610 x 305 |
| **220** | 940 | 26 | 1080 | 7 | | 2 |
| **230** | 940 | 26 | 1080 | 7 | | 2 |
| **240** | 1890 | 52 | 2170 | 14 | | 4 |
| **330** | 1920 | 47 | 2190 | 12 | 1 | 2 |
| **340** | 2890 | 68 | 3310 | 17 | 2 | 2 |
| **350** | 3360 | 81 | 3830 | 21 | 2 | 3 |
| **360** | 4330 | 102 | 4960 | 26 | 3 | 3 |
| **370** | 4810 | 115 | 5490 | 29 | 3 | 4 |
| **440** | 3900 | 84 | 4460 | 20 | 4 | |
| **450** | 4850 | 110 | 5540 | 27 | 4 | 2 |
| **460** | 5850 | 126 | 6680 | 30 | 6 | |
| **470** | 6790 | 152 | 7760 | 37 | 6 | 2 |
| **480** | 7790 | 168 | 8900 | 40 | 8 | |
| **550** | 5780 | 136 | 6610 | 34 | 4 | 4 |
| **560** | 7260 | 165 | 8310 | 41 | 6 | 3 |
| **570** | 8210 | 191 | 9390 | 48 | 6 | 5 |
| **580** | 9680 | 220 | 11070 | 54 | 8 | 4 |
| **660** | 8780 | 189 | 10040 | 45 | 9 | |
| **670** | 10180 | 228 | 11640 | 56 | 9 | 3 |
| **680** | 11700 | 252 | 13360 | 60 | 12 | |
| **770** | 11600 | 267 | 13250 | 66 | 9 | 6 |
| **780** | 12470 | 304 | 15530 | 74 | 12 | 4 |
| **7100** | 16970 | 380 | 19390 | 93 | 15 | 5 |

**Absolute filters and rigid bag filters in frames**

# Fans

## GENERAL

Fans offered for the 39F Air Handling Units are from high performance centrifugal fans. The fan quality, airside and acoustics performances of the fans are tested in compliance with international standard either AMCA or DIN. The fans are able to operate in a temperature range of –20°C to +80°C. Fan housing is made of galvanized steel; phosphated with lap joint and treated with high quality are anti-corrosion protected.

### Fan Laws

For a given distribution system and specific air weight, the following laws in relation to volume, pressure and fan power applied dependent upon fan speed.

- The volume (V) changes as the fan speed (n) changes

$$V_2 = V_1 \frac{n_2}{n_1}$$

- The pressure (p) changes with the square of the speed (n)

$$P_2 = P_1 \left( \frac{n_2}{n_1} \right) 2$$

- The absorbed power (PW) changes with the cube of the speed (n)

$$Pw_2 = Pw_1 \left( \frac{n_2}{n_1} \right) 3$$

- As the specific weight of the air changes, the air quantities remain constant.
- The pressure and the absorbed power change with the specific weight.

$$V_2 = V_1 \frac{n_2}{n_1} \quad \text{and} \quad V2 = V1 \frac{n_2}{n_1}$$

### Reference Values

The fan curves refer to a specific weight of 1.2 kg/m3 at a temperature of 20°C at atmospheric pressure of 101.3 kPa (760 mm Hg) and a relative humidity of 50%.

## DESCRIPTION

### Types of Fans (Click here for Fan Curves)

39FD,FX Air Handling Units are supplied with double inlet double width (DIDW) centrifugal blowers of either,

- forward curved
- backward curved
- airfoil curve

### Construction

1. Fan casings are constructed of galvanized steel with a series of punched holes or nutserts allowing the fixing of accessories such as frames or support legs thus providing a variety of discharge positions.
2. The impeller is galvanized finished for forward curve blade and epoxy painted for backward airfoil blade. All impeller are statically and dynamically balanced to the operating fan speed as a single unit to specification G25 in accordance to DIN ISO Standard 1940.
3. Both forward and backward impellers are with laminar design and airfoil impellers are with aerodynamic design.
4. Fans are securely fixed to mild steel shaft machined to close tolerance (g6) and coated with colored wax to protect from corrosion. Shafts are precision trued and ground. The drive side is machined to fit standard V-belt pulleys and the shaft ends are grooved and keyed.
5. Types of bearing supplied as standard depend on fan class and size, and another type supplied as an option,
   - Standard Fan - size 160 to 1000 for forward and backward curve fans (airfoil fan up to size 710). Radial insert ball bearings with spherical outer ring mounted within cast iron housing supported from the fan casing by tabular struts.
   - Option Fan - size 400 to 1000 (reinforced airfoil fan). Self-aligning double row ball bearing secured by adapter sleeve, mounted within cast iron housing.
   - Option Fan - size 400 to 1000 (option-super reinforced). Self-aligning double row ball bearings within standard plummer blocks, mounted on robust pedestal.

   All bearings are pre-lubricated and maintenance free. Nominal life expectancy is designed up to 40,000 $L_{10}$ operating hours (according to DIN ISO 281 Section 1). Rated bearing life can reach up to 200,000 $L_{10}$ hours.
6. *Carrier* 39FD/FX offers an optional Inlet Vane Controller / Inlet Guide Vane (IGV) depends

on requirements and applications. The IGV is mounted directly inside each inlet cone with no external projection. The vane blades are non-aerofoil, galvanized metal pieces which run in plastic bearings to reduce chatter sound. The blades can be adjusted from 0 to 90° angle by a single actuator for double inlet or hand control if required.

**INSTALLATION**

Fan, motor and drives are mounted on a fan and motor base (FMB) that is isolated from the Air Handling Unit by a set of anti vibration isolators at the bottom and fan discharge is connected to the fan panel discharge with a fire retardant flexible connection. Supply air duct can be directly connected to the discharge panel flange.

Standard fan and motor casing is supplied with hinged access door at drive side.

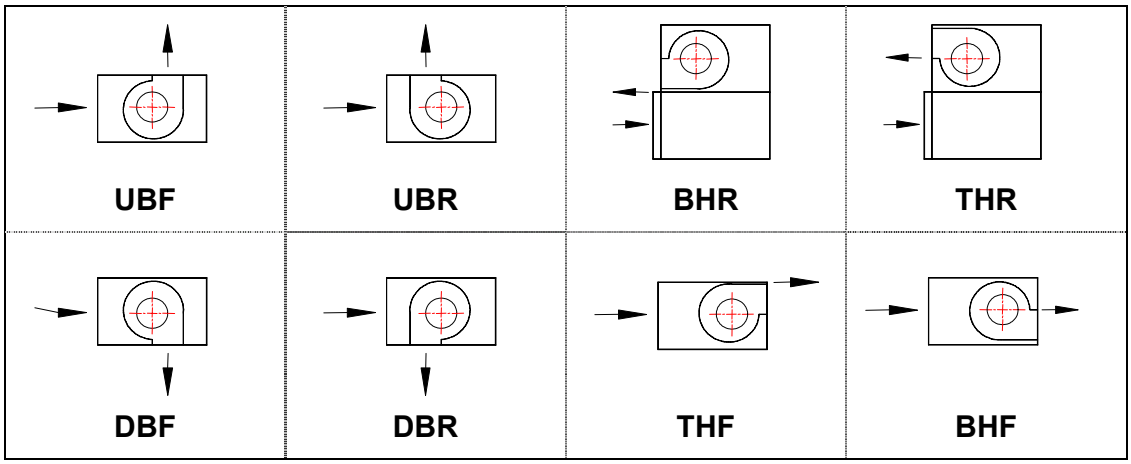
**RECOMMENDATIONS**

The air to be handled in the unit must be clean and non-corrosive.

Each Air Handling Unit can have a choice of several fan types with best efficiency and lowest sound level should be selected for a specific installation.

**FAN ARRANGEMENT**

Fan installation for 39FD/FX comes in different arrangements as per application requirements. Different configurations are shown below.




*Fan arrangement*

**FAN SHAFT SIZES – FORWARD, BACKWARD & (AIRFOIL)**

| Fan sizes | 160 | 180 | 200 | 225 | 250 | 280 | 315 | 355 |
|---|---|---|---|---|---|---|---|---|
| Diameter, mm | 20(20) | 20(20) | 20(20) | 20(20) | 20(20) | 25(24) | 25(24) | 30(24) |

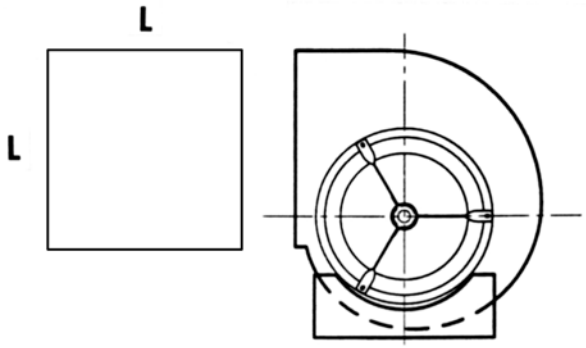
| Fan sizes | 400 | 450 | 500 | 560 | 630 | 710 | 800 | 900 | 1000 |
|---|---|---|---|---|---|---|---|---|---|
| Diameter, mm | 30(28) | 35(28) | 35(28) | 40(38) | 40(38) | 50(48) | 50(48) | 60(55) | 60(55) |

**IGV TORQUE – BACKWARD & (AIRFOIL)**

| Fan sizes | 355 | 400 | 450 | 500 | 560 | 630 | 710 | 800 | 900 | 1000 |
|---|---|---|---|---|---|---|---|---|---|---|
| $Torque_{max}$*, Nm | 11 | 15(17) | 20(25) | 33(37) | 35(39) | 45(55) | 65(78) | 108(128) | 131(157) | 164(196) |

** Maximum torque at the pivot is reached at maximum fan speed and least favorable blade angle, figure include a safety margin*

**FAN OUTLET OPENING**




| Fan sizes | 160 | 180 | 200 | 225 | 250 | 280 | 315 | 355 |
|---|---|---|---|---|---|---|---|---|
| L, mm | 205 | 229 | 256 | 288 | 322 | 361 | 404 | 453 |

| Fan sizes | 400 | 450 | 500 | 560 | 630 | 710 | 800 | 900 | 1000 |
|---|---|---|---|---|---|---|---|---|---|
| L, mm | 507 | 569 | 638 | 715 | 801 | 898 | 1007 | 1130 | 1267 |

**(Click here for Fan Curves)**

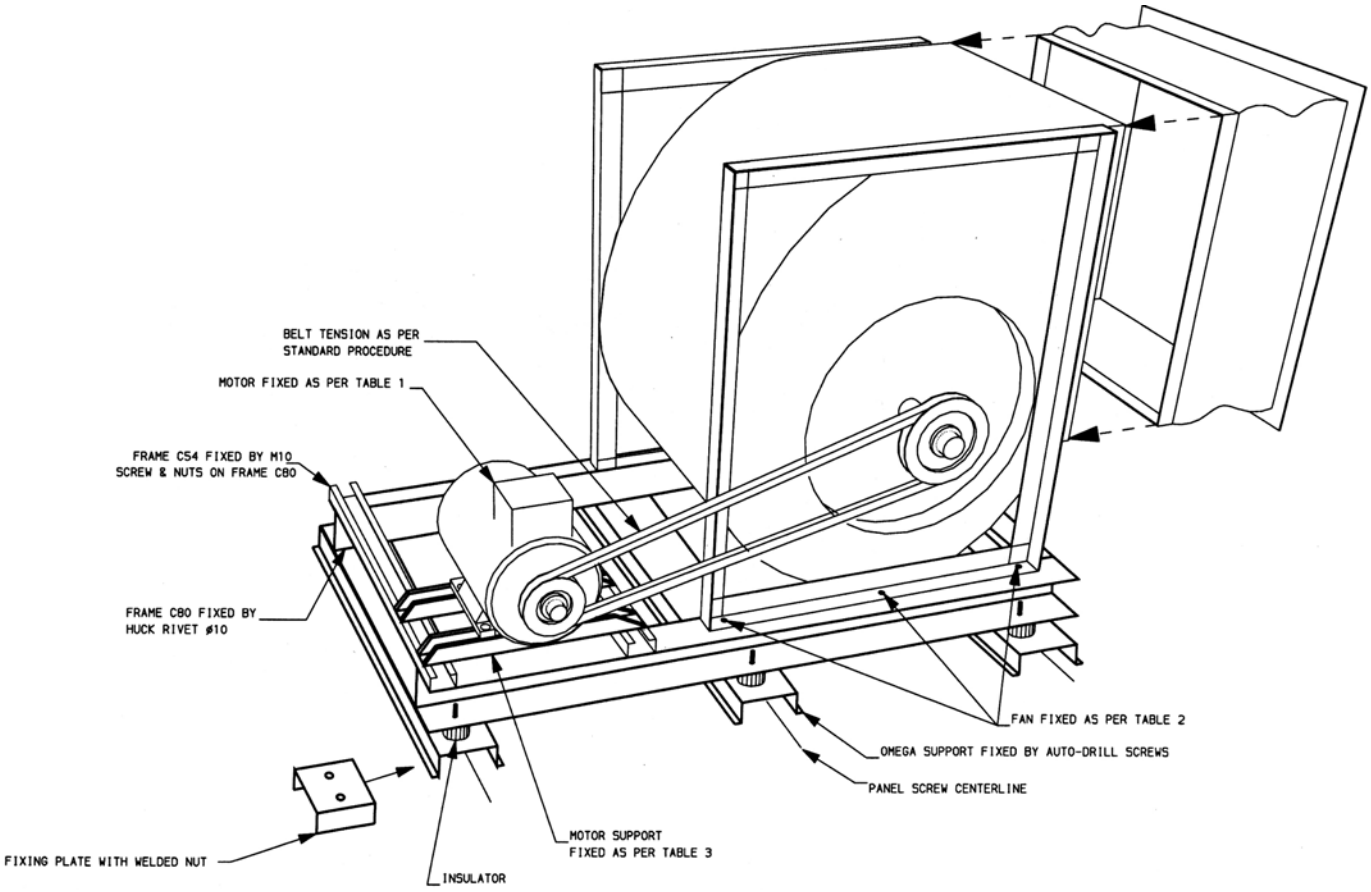

BELT TENSION AS PER STANDARD PROCEDURE
MOTOR FIXED AS PER TABLE 1
FRAME C54 FIXED BY M10 SCREW & NUTS ON FRAME C80
FRAME C80 FIXED BY HUCK RIVET ø10
FIXING PLATE WITH WELDED NUT
INSULATOR
MOTOR SUPPORT FIXED AS PER TABLE 3
FAN FIXED AS PER TABLE 2
OMEGA SUPPORT FIXED BY AUTO-DRILL SCREWS
PANEL SCREW CENTERLINE

TABLE 1

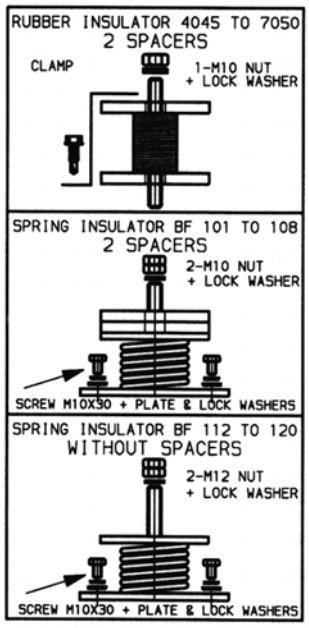
| FRAME SIZE | DIAMETER | ITEMS LIST |
|---|---|---|
| 160 TO 180 | M12 | SCREW + PLATE WASHER + LOCK WASHER + NUT |
| | | |
| 200 TO 225 | M16 | SCREW + PLATE NUT LOCK WASHER + NUT |
| 250 TO 280 | M20 | |
| | | |

TABLE 2

| FAN SIZE | DIAMETER | ITEMS LIST |
|---|---|---|
| 500 TO 1000 | M10 | SCREW + PLATE WASHER + LOCK WASHER + NUT |
| | | |
| | | |

TABLE 3

| MOTOR SUPPORT | DIAMETER | ITEMS LIST |
|---|---|---|
| L=500 | M12 | SCREW + LOCK WASHER + PLATE NUT |
| L=864 | M16 | |
| L=1072 | M20 | |


RUBBER INSULATOR 4045 TO 7050
2 SPACERS
CLAMP
1-M10 NUT + LOCK WASHER
SPRING INSULATOR BF 101 TO 108
2 SPACERS
2-M10 NUT + LOCK WASHER
SCREW M10X90 + PLATE & LOCK WASHERS
SPRING INSULATOR BF 112 TO 120
WITHOUT SPACERS
2-M12 NUT + LOCK WASHER
SCREW M10X30 + PLATE & LOCK WASHERS

**Fan and Motor Assembly on the Fan and Motor Base (FMB)**

Forward curve impeller

Backward curve impeller

Airfoil fan with standard reinforced fan housing (IGV installed)

# Motors

**Features**

Standard features on motors used with *Carrier* 39F centrifugal fans are as below.

- Motors are of Totally Enclosed Fan Cooled (TEFC) type with finned casing surface.
- Index of Protection IP 55 that protect motor from dust and water.
- Metal frame from aluminum and steel for excellence heat transfer, strength and ruggedness.
- Single and dual speed motor.
- 3-phase, DOL, Star-Delta induction motor with six terminals.
- PTO (thermal overload protection – normally closed), protecting motor when temperature reaches 170°C
- Insulation class F at 50°C ambient temperature and continuos duty.
- Voltage tolerance +/- 10% and frequency tolerance +/- 5%.
- Normal operating condition compliance with IEC 34-1 within ambient $-16^0$C and $+40^0$C at below 1000 meter altitudes and at 1050 hPa (mbar) atmospheric pressure.
- Comply with IEC Standard with UL listing*.

**Construction**

Motors are with standard foot mounted, finned housing with integral feet of 4 to 6 screw holes. Shaft is from steel and shaft end fitted with screw and closed keyway. Motors are cooled as " surface-cooled machine using the ambient air circulating round the machine" as per IEC 34.6 method IC 41. Terminal box is IP 55 protection. All standard motor are supplied with wiring diagram that available in the terminal box. Earth terminal is located in the terminal box.

**Motor Sizing**

Motor selection shall consider the mechanical losses in transmitting the load from motor shaft to fan shaft. Mechanical losses factor, K, are recommended as follow.

K = 1.20 for fan with brake kW is 10kW and below.

K = 1.15 for fan with brake kW is above 10kW.

Standard motor is with power supply 3ph/ 230V/400V/ 50Hz. Motor data published are based to these parameters. Other applications are also available, please contact *Carrier* office.

**50Hz Two Poles Motor - Technical data**

| Frame size | Power kW | RPM | FLC 400V | Power Factor | LRC/FLC | Weight kg | Shaft Diameter mm |
|---|---|---|---|---|---|---|---|
| 63MA | 0.18 | 2800 | 0.6 | 0.71 | 3.3 | 4.5 | 11 |
| 63MB | 0.25 | 2800 | 0.7 | 0.74 | 3.5 | 4.7 | 11 |
| 71MA | 0.37 | 2800 | 1.1 | 0.75 | 3.7 | 5.6 | 14 |
| 71MB | 0.55 | 2800 | 1.4 | 0.78 | 3.9 | 7.0 | 14 |
| 80MA | 0.75 | 2810 | 1.8 | 0.80 | 4.9 | 10.6 | 19 |
| 80MB | 1.1 | 2810 | 2.5 | 0.83 | 5 | 11.5 | 19 |
| 90S | 1.5 | 2820 | 3.3 | 0.85 | 5 | 13.6 | 24 |
| 90L | 2.2 | 2820 | 4.7 | 0.85 | 5.1 | 15.8 | 24 |
| 100L | 3 | 2825 | 6 | 0.88 | 6.5 | 17.8 | 28 |
| 112M | 4 | 2890 | 8 | 0.86 | 6.8 | 25.5 | 28 |
| 132SR | 5.5 | 2890 | 11 | 0.84 | 6.5 | 32.0 | 38 |
| 132SH | 7.5 | 2860 | 15 | 0.85 | 6 | 36.0 | 38 |
| 160MR | 11 | 2910 | 21 | 0.87 | 6 | 91.0 | 42 |
| 160MH | 15 | 2925 | 28 | 0.88 | 7.2 | 103.0 | 42 |
| 160L | 18.5 | 2930 | 34 | 0.88 | 7.6 | 120.0 | 42 |
| 180M | 22 | 2955 | 39 | 0.90 | 8 | 148.0 | 48 |
| 200LR | 30 | 2960 | 52 | 0.91 | 7.6 | 244.0 | 55 |
| 200LH | 37 | 2965 | 64 | 0.90 | 7.5 | 270.0 | 55 |
| 225M | 45 | 2967 | 72 | 0.89 | 7 | 335.0 | 55 |
| 250M | 55 | 2970 | 98 | 0.90 | 6.9 | 410.0 | 60 |
| 280S | 75 | 2973 | 128 | 0.91 | 7.5 | 355.0 | 65 |

* For High Efficiency Motor Only

**50 Hz Four Poles Motor - Technical data**

| Frame size | Power kW | RPM | FLC 400V | Power Factor | LRC/FLC | Weight kg | Shaft Diameter mm |
|---|---|---|---|---|---|---|---|
| 63MA | 0.12 | 1380 | 0.5 | 0.63 | 2.80 | 4.4 | 11 |
| 63MB | 0.18 | 1380 | 0.7 | 0.64 | 2.90 | 4.7 | 11 |
| 71MA | 0.25 | 1380 | 0.9 | 0.65 | 3.10 | 5.4 | 14 |
| 71MB | 0.37 | 1380 | 1.2 | 0.66 | 3.20 | 6.7 | 14 |
| 80MA | 0.55 | 1400 | 1.7 | 0.70 | 3.40 | 9.7 | 19 |
| 80MB | 0.75 | 1400 | 2.1 | 0.73 | 3.60 | 11.3 | 19 |
| 90S | 1.1 | 1400 | 2.8 | 0.75 | 3.50 | 12.7 | 24 |
| 90L | 1.5 | 1400 | 3.8 | 0.76 | 3.80 | 15.5 | 24 |
| 100LR | 2.2 | 1415 | 5.3 | 0.78 | 5.30 | 17.0 | 28 |
| 100LH | 3 | 1405 | 6.8 | 0.80 | 5.50 | 21.0 | 29 |
| 112M | 4 | 1430 | 8.6 | 0.80 | 6.20 | 27.5 | 28 |
| 132S | 5.5 | 1450 | 11.3 | 0.81 | 6.30 | 41.0 | 38 |
| 132M | 7.5 | 1455 | 15.2 | 0.83 | 6.50 | 46.0 | 38 |
| 132MH | 9 | 1455 | 18 | 0.82 | 7.00 | 52.0 | 38 |
| 160M | 11 | 1460 | 21 | 0.80 | 7.00 | 105.0 | 42 |
| 160L | 15 | 1460 | 29 | 0.83 | 7.50 | 126.0 | 42 |
| 180M | 18.5 | 1460 | 36 | 0.82 | 6.00 | 136.0 | 48 |
| 180L | 22 | 1460 | 43 | 0.81 | 6.00 | 154.0 | 48 |
| 200L | 30 | 1475 | 58 | 0.81 | 7.00 | 253.0 | 55 |
| 225S | 37 | 1475 | 66 | 0.88 | 6.30 | 320.0 | 60 |
| 225M | 45 | 1480 | 79 | 0.88 | 7.00 | 345.0 | 60 |
| 250M | 55 | 1483 | 94 | 0.90 | 7.30 | 425.0 | 65 |
| 280S | 75 | 1485 | 125 | 0.90 | 7.30 | 565.0 | 75 |

**60 Hz Two Poles Motor - Technical data**

| Frame size | Power kW | RPM | FLC 400V | Power Factor | LRC/FLC | Weight kg | Shaft Diameter mm |
|---|---|---|---|---|---|---|---|
| 63MA | 0.18 | 3240 | 0.6 | 0.68 | 3.6 | 4.5 | 11 |
| 63MB | 0.25 | 3420 | 0.7 | 0.68 | 3.8 | 4.7 | 11 |
| 71MA | 0.37 | 3450 | 1.1 | 0.70 | 4.2 | 5.6 | 14 |
| 71MB | 0.55 | 3450 | 1.4 | 0.78 | 4.4 | 7.0 | 14 |
| 80MA | 0.75 | 3450 | 1.8 | 0.79 | 5.5 | 10.6 | 19 |
| 80MB | 1.1 | 3440 | 2.5 | 0.80 | 5.6 | 11.5 | 19 |
| 90S | 1.5 | 3420 | 3.3 | 0.85 | 5.7 | 13.6 | 24 |
| 90L | 2.2 | 3450 | 4.7 | 0.80 | 5.8 | 15.8 | 24 |
| 100L | 3 | 3450 | 6 | 0.87 | 6.8 | 17.8 | 28 |
| 112M | 4 | 3495 | 8.4 | 0.86 | 6.5 | 25.5 | 28 |
| 132SR | 5.5 | 3490 | 10 | 0.92 | 6.5 | 32.0 | 38 |
| 132SH | 7.5 | 3465 | 14.3 | 0.90 | 6.6 | 36.0 | 38 |
| 160MR | 11 | 3515 | 20 | 0.90 | 6 | 91.0 | 42 |
| 160MH | 15 | 3525 | 27 | 0.90 | 7.2 | 103.0 | 42 |
| 160L | 18.5 | 3525 | 32 | 0.92 | 7.6 | 120.0 | 42 |
| 180M | 22 | 3555 | 39 | 0.90 | 9 | 148.0 | 48 |
| 200LR | 30 | 3560 | 52 | 0.91 | 8 | 244.0 | 55 |
| 200LH | 37 | 3565 | 64 | 0.90 | 8 | 270.0 | 55 |
| 225M | 45 | 3565 | 72 | 0.89 | 7.7 | 335.0 | 55 |
| 250M | 55 | 3565 | 98 | 0.90 | 7.5 | 410.0 | 60 |
| 280S | 75 | 3568 | 128 | 0.91 | 8 | 355.0 | 65 |

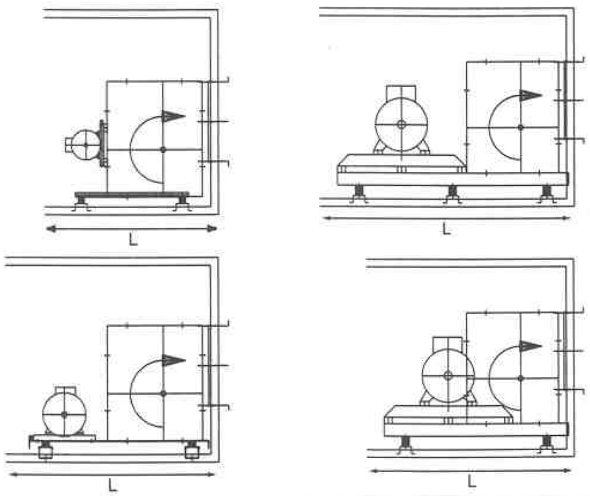
**60 Hz Four Poles Motor - Technical data**

| Frame size | Power kW | RPM | FLC 400V | Power Factor | LRC/FLC | Weight kg | Shaft Diameter mm |
|---|---|---|---|---|---|---|---|
| 63MA | 0.12 | 1708 | 0.5 | 0.60 | 2.8 | 4.4 | 11 |
| 63MB | 0.18 | 1708 | 0.7 | 0.60 | 2.9 | 4.7 | 11 |
| 71MA | 0.25 | 1715 | 0.9 | 0.64 | 3.1 | 5.4 | 14 |
| 71MB | 0.37 | 1700 | 1.3 | 0.65 | 3.2 | 6.7 | 14 |
| 80MA | 0.55 | 1740 | 1.6 | 0.70 | 3.4 | 9.7 | 19 |
| 80MB | 0.75 | 1725 | 2.1 | 0.73 | 3.6 | 11.3 | 19 |
| 90S | 1.1 | 1720 | 2.7 | 0.74 | 3.5 | 12.7 | 24 |
| 90L | 1.5 | 1715 | 3.6 | 0.75 | 3.8 | 15.5 | 24 |
| 100LR | 2.2 | 1730 | 5.3 | 0.75 | 5.3 | 17.0 | 28 |
| 100LH | 3 | 1720 | 6.7 | 0.80 | 5.5 | 21.0 | 29 |
| 112M | 4 | 1725 | 8.4 | 0.83 | 6.8 | 27.5 | 28 |
| 132S | 5.5 | 1740 | 11 | 0.83 | 7 | 41.0 | 38 |
| 132M | 7.5 | 1740 | 15 | 0.82 | 7 | 46.0 | 38 |
| 132MH | 9 | 1740 | 18.5 | 0.82 | 7.5 | 52.0 | 38 |
| 160M | 11 | 1765 | 21 | 0.85 | 7.5 | 105.0 | 42 |
| 160L | 15 | 1765 | 29 | 0.84 | 7.5 | 126.0 | 42 |
| 180M | 18.5 | 1770 | 36 | 0.82 | 6.5 | 136.0 | 48 |
| 180L | 22 | 1770 | 43 | 0.82 | 7 | 154.0 | 48 |
| 200L | 30 | 1770 | 55 | 0.85 | 6.5 | 253.0 | 55 |
| 225S | 37 | 1780 | 66 | 0.88 | 6.8 | 320.0 | 60 |
| 225M | 45 | 1785 | 79 | 0.88 | 7.5 | 345.0 | 60 |
| 250M | 55 | 1785 | 94 | 0.90 | 7.5 | 425.0 | 65 |
| 280S | 75 | 1785 | 125 | 0.90 | 7.5 | 565.0 | 75 |

**Installation**

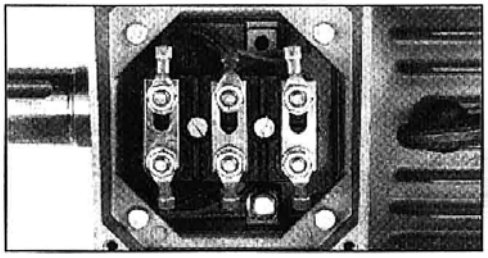
Motor is mounted on an adjustable base so that belt tension can be easily adjusted. Dependent upon motor power and fan size the motor can be installed:

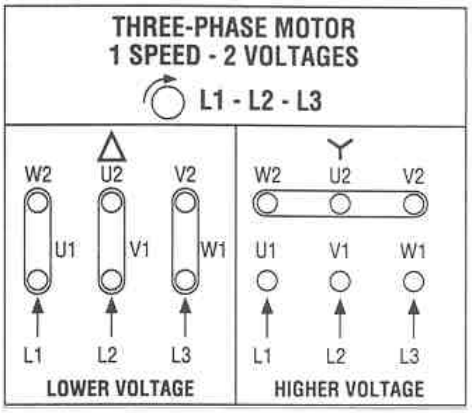
- on the base frame at the back of the fan
- on the base frame at the side of the fan
- on the fan casing (max motor power 5.5 kW)

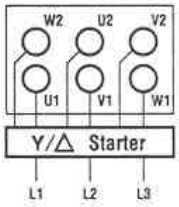


**Terminal block and connections**

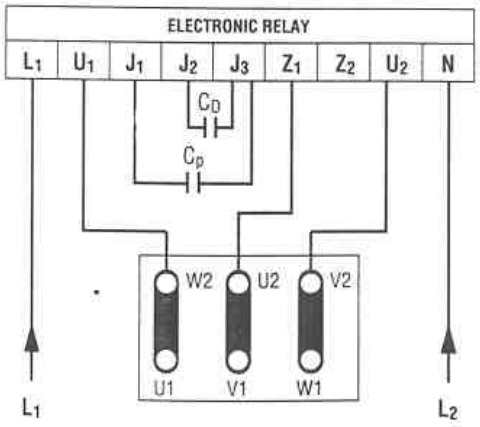
Standard motors are fitted with six terminals and these terminals are marked complying with IEC 34.8. Terminal connection and wiring diagrams are supplied in terminal box. Sample wiring connections are as below diagram.






External wiring diagram




*Note : to change the direction of rotation, connect $W_2$ motor to $U_2$ relay terminal, $V_2$ motor to $U_1$ relay terminal.*

# Drives

Transmission of power from fan motor to fan is provided by means of a set of pulleys and matching v-belts. The pulleys are taperlocked to the fan and motor shaft. Optional variable pitch pulley fixed to the motor shaft is available for motor size up to 5.5 kW. *Carrier* 39F Air Handling Units are supplied with optimized pulleys and belts sizes and pre-installed by factory. Proper drives sizing and installation will ensure fan to rotate at required designed speed and at the same time help to optimize fan and motor bearing life.

**Pulley with taper bushing**

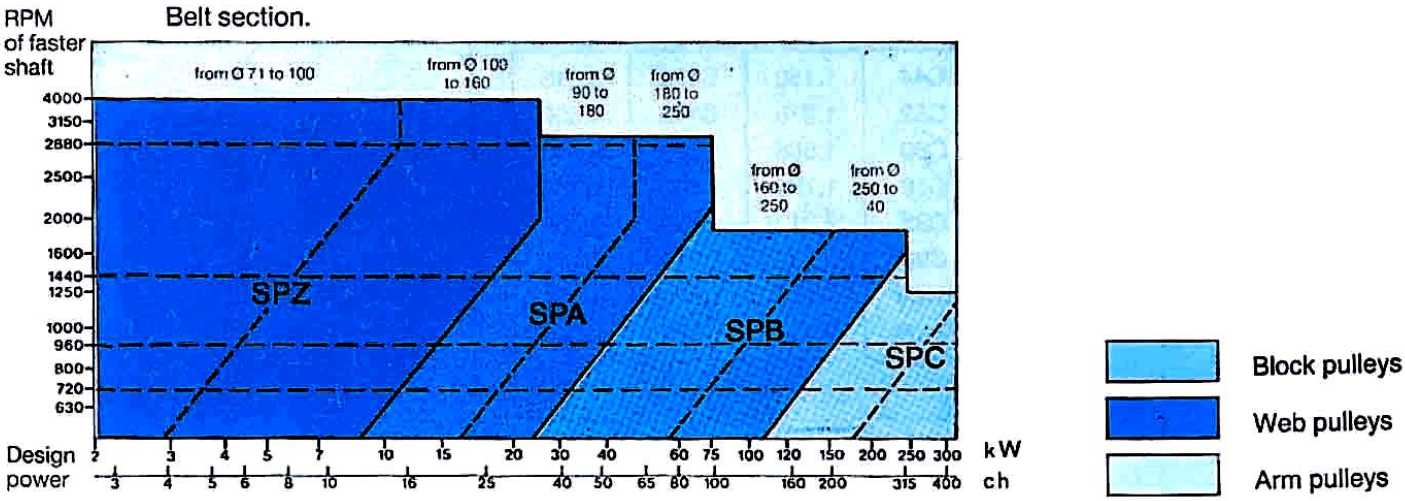
Common pulleys supplied in 39F Air Handling Units are:

1. Block pulleys
2. Web pulleys
3. Arm pulleys

**Wedge belts**

Common wedge belts supplied in 39F Air Handling Units are:

1. SPA – 13W X 8H X Length
2. SPB – 17W X 11H X Length
3. SPC – 22W X 14H X Length
4. SPD – 32W X 19H X Length
5. SPZ – 10W X 6H X Length




Common pulleys for wedge belts (SPA, SPB and SPZ) application.

# Coils

**FEATURES**

- Carrier 39F Air Handling Units offering several coil applications such as chilled water, hot water, direct expansion (DX) and steam coil.
- Coils performances are rated accordance to ARI 410.
- Coil designed and manufactured as per *Carrier* Standard and according to ANSI and DIN Standard.
- Coils come in a cartridge type construction with a single pair as standard or dual connection pairs as option.
- Header and connection for DX coil application is made of copper with sweat connection while for water coils are with steel header connection and threaded end (11 TPI) is supplied as standard.
- All water coil headers are equipped with drain and vent connections.
- Tubes are mechanically expanded to collar fins.
- Slide-in and slide-out construction on coil track provides easy coil removal for service and maintenance.
- Coils are factories tested at 300 psig and maximum working pressure is 230 psig.
- All coils shall have counter flow arrangement.
- Coil frames are from galvanized steel and painted.
- DX coil is equipped with distributor head and tube feeders to the coil circuiting.

Other coil specifications and features please contact your nearest *Carrier* office.

**SELECTION**

Coil calculation and optimization is done by selection software. Flexible coil standard features and offerings shall be as follows,

1. *No of rows*: 1 up to 10 rows.
2. *Fin spacing*: 1.8mm (14 fpi), 2mm (13 fpi), 2.3mm (11 fpi), 2.5mm (10 fpi), 3mm (8 fpi)
3. *Copper tube thickness*: 0.35mm for 1/2" tube
4. *Aluminum fin thickness*: 0.12mm for 1/2" tube
5. *Coil circuiting*: Optimize by selection software
6. *Coil options available such as* Cu/Cu coil, steel coil and Blygold coating.

All other types or materials of coil with configuration other than as described above are selected and supplied on request. For details and more information on other specifications and features, please contact your nearest *Carrier* office.

**RECOMMENDATIONS**

For standard or customized coils, recommended maximum allowable face velocity is:

| | |
|---|---|
| v = 4.5m/s | heating coil or dry coil |
| v = 3.15m/s | dehumidifying cooling coils with droplet eliminator |
| v = 2.5m/s | dehumidifying cooling coils without droplet eliminator |

Where necessary, a droplet eliminator is automatically included by the computer selection program. Water circuits provided for standard coils are factory selected to limit the pressure loss to 100 kPa on hot water coils and to 250 kPa on chilled water coils.

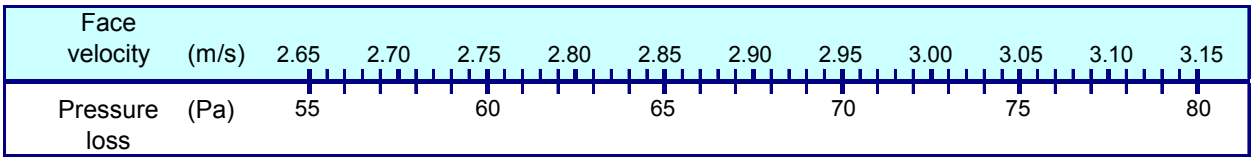
A U-trap of height equal to twice the fan static pressure must be provided on site by installer. This will ensure proper flow of condensate water out from the drain pan.

**CONDENSATE DRAIN PAN**

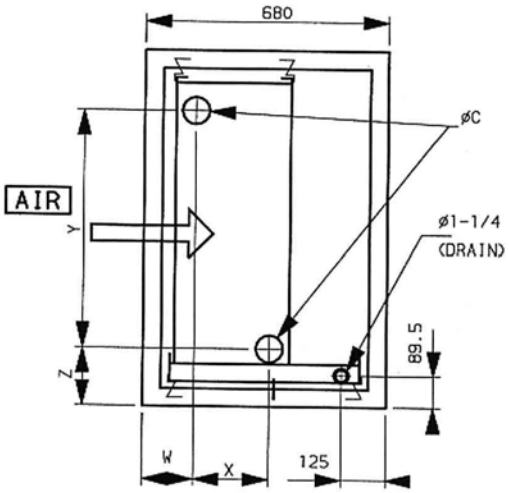
Condensate drain pan shall be from galvanized, minimum spangle G90 material and internally coated with corrosion resistance and elastic black asphalt. The internal coating material complies with NFPA 90 A for flame spread and smoke generation. The drain pan is mounted onto a slider track with drain pan with bottom sloped from 0.4° up to 0.7° angle to ensure complete and positive drainage to meet with ASHRAE 62-89 requirement. Insulated drain pan is available as standard.

**COIL CONSTRUCTION AND INSTALLATION**

Coils are assembled and installed in a two modules length coil casing. Hot water coil or other dry coil application required only one module casing length. For wet coil application, coil is mounted inside a drain pan. Top coil and bottom drain pan are supported with Z-Profiles to secure to it position. Z-Profiles also provides access to slide the coil and drain pan to ease installation and coil maintenance works. Coil casings are with external mounting screw panels access for maintenance purposes.




Air pressure loss through droplet eliminator




Chilled water coil sitting.

Notes:
1. Coil section length (refer dimensions in table below)
2. Dimensions are based on 25mm thick casing
3. For 50mm thick casing, add 25mm to the following dimensions,
   a. W
   b. Z
   c. 125mm
   d. 89.5mm

## Standard Coil Sitting and External Fitting Table

| Unit Size | No. of Rows | C | W | X | Z | Y |
|---|---|---|---|---|---|---|
| **340** | 1 | 1-1/4" | 141 | 92 | 163 | 712 |
| | 2 | 1-1/4" | 150.5 | 73 | 147 | 728 |
| | 4 | 2-1/2" | 171 | 82 | 164 | 694 |
| | 6 | 2-1/2" | 168.5 | 137 | 164 | 694 |
| | 8 | 2-1/2" | 166 | 192 | 164 | 694 |
| **350** | 1 | 1-1/4" | 141 | 92 | 163 | 712 |
| | 2 | 1-1/2" | 150.5 | 73 | 150 | 722 |
| | 4 | 2-1/2" | 171 | 82 | 164 | 694 |
| | 6 | 2-1/2" | 168.5 | 137 | 164 | 694 |
| | 8 | 3" | 166 | 192 | 170 | 681 |
| **360** | 1 | 1-1/4" | 141 | 92 | 163 | 712 |
| | 2 | 2-1/2" | 146 | 82 | 164 | 694 |
| | 4 | 2-1/2" | 171 | 82 | 164 | 694 |
| | 6 | 3" | 168.5 | 137 | 170 | 681 |
| | 8 | 3" | 166 | 192 | 170 | 681 |

*Continue on next page*

| Unit Size | No. of Rows | C | W | X | Z | Y |
|---|---|---|---|---|---|---|
| **370** | 1 | 1-1/2" | 141 | 92 | 166 | 706 |
| | 2 | 2-1/2" | 146 | 82 | 164 | 694 |
| | 4 | 3" | 157.5 | 109 | 170 | 681 |
| | 6 | 3" | 168.5 | 137 | 170 | 681 |
| | 8 | 3" | 166 | 192 | 170 | 681 |
| **440** | 1 | 1-1/4" | 141 | 92 | 164 | 1028 |
| | 2 | 1-1/4" | 150.5 | 73 | 147 | 1045 |
| | 4 | 2-1/2" | 171 | 82 | 164 | 1012 |
| | 6 | 2-1/2" | 168.5 | 137 | 164 | 1012 |
| | 8 | 2-1/2" | 166 | 192 | 164 | 1012 |
| **450** | 1 | 1-1/4" | 141 | 92 | 164 | 1028 |
| | 2 | 1-1/2" | 150.5 | 73 | 150 | 1039 |
| | 4 | 2-1/2" | 171 | 82 | 164 | 1012 |
| | 6 | 2-1/2" | 168.5 | 137 | 164 | 1011 |
| | 8 | 3" | 166 | 192 | 170 | 999 |
| **460** | 1 | 1-1/4" | 141 | 92 | 164 | 1028 |
| | 2 | 2-1/2" | 146 | 82 | 164 | 1012 |
| | 4 | 2-1/2" | 171 | 82 | 164 | 1012 |
| | 6 | 3" | 168.5 | 137 | 170 | 999 |
| | 8 | 3" | 166 | 192 | 170 | 999 |
| **470** | 1 | 1-1/2" | 141 | 92 | 166 | 1023 |
| | 2 | 2-1/2" | 146 | 82 | 164 | 1012 |
| | 4 | 3" | 157.5 | 109 | 170 | 999 |
| | 6 | 3" | 168.5 | 137 | 170 | 999 |
| | 8 | 3" | 166 | 192 | 170 | 999 |
| **480** | 1 | 1-1/4" | 141 | 92 | 164 | 1028 |
| | 2 | 2-1/2" | 146 | 82 | 164 | 1012 |
| | 4 | 3" | 157.5 | 109 | 170 | 999 |
| | 6 | 3" | 168.5 | 137 | 170 | 999 |
| | 8 | 3" | 166 | 192 | 170 | 999 |
| **550** | 1 | 1-1/4" | 141 | 92 | 164 | 1346 |
| | 2 | 1-1/2" | 150.5 | 73 | 150 | 1357 |
| | 4 | 2-1/2" | 171 | 82 | 164 | 1329 |
| | 6 | 2-1/2" | 168.5 | 137 | 164 | 1329 |
| | 8 | 3" | 166 | 192 | 170 | 1316 |
| **560** | 1 | 1-1/4" | 141 | 92 | 164 | 1346 |
| | 2 | 2-1/2" | 146 | 82 | 164 | 1329 |
| | 4 | 2-1/2" | 171 | 82 | 164 | 1329 |
| | 6 | 3" | 168.5 | 137 | 170 | 1316 |
| | 8 | 3" | 166 | 192 | 170 | 1316 |
| **570** | 1 | 1-1/2" | 141 | 92 | 166 | 1341 |
| | 2 | 2-1/2" | 146 | 82 | 164 | 1329 |
| | 4 | 3" | 157.5 | 109 | 170 | 1316 |
| | 6 | 3" | 168.5 | 137 | 170 | 1316 |
| | 8 | 3" | 166 | 192 | 170 | 1316 |
| **580** | 1 | 1-1/4" | 141 | 92 | 164 | 1346 |
| | 2 | 2-1/2" | 146 | 82 | 164 | 1329 |
| | 4 | 3" | 157.5 | 109 | 170 | 1316 |
| | 6 | 3" | 168.5 | 137 | 170 | 1316 |
| | 8 | 3" | 166 | 192 | 170 | 1316 |

# Electric Heaters

**General**

- Electric heater shall be of the cartridge type.
- Heaters shall be framed with a slide in-out track so that the complete assembly is removable.

**Standard Electric Heater – Open Wire Type**

- Standard electric heater shall be from Open Wire Type.
- Heating wire shall be of composition 80% Ni and 20% Cr.
- Heater assembly, the basic components shall be include airflow switch, power & control terminal board, grounding lug and primary & secondary over load temperature sensor.
- Components are assembled inside terminal box integrated with heating elements frame assembly.
- Frames shall be from a heavy gauge (G16) galvanized steel frame.

**Remote Control Panel (option)**

- Remote Control Panel shall include basic components such as a de-energizing magnetic control contactor per stage or each 48 AMP circuit within a stage, a magnetic back-up contactor for each 48AMP circuit, power & control terminal board, grounding lug and high & low voltage terminal boards.
- Control Panel's box shall be made from painted galvanized steel and weatherproof construction.

**Closed Finned Heater Type (option)**

- Heating element is made of composition 80% Ni and 20% Cr.
- Assembly of the heating element is secured inside the stainless steel spherical sheathed fins copper tube.
- Heating component is according to AISI 321 and AISI 430.
- Heating elements are wired in star or delta according to the power supply and pre wired to the terminal block in the wiring box.
- Safety thermostat (rating at 16 (2) A / 380 V ) with a 98 °C ( +0/-16 °C ) cut out is supplied and it is manually reset. Heating elements are mounted to a heavy gauge (G16) galvanized steel frame.

**Access Panel**

- Totally removable panel shall be assembled at both casing wall and bolted externally for air-tightness, easy remove and reassemble panel to facilitate access for servicing and maintenance.

**SELECTION**

*Example*:

- Unit 39FD 570 with 8300 l/s.
- Temperature increase of 12°C is required.
- Heating load
  $Q = 1.21 \times \Delta t \times V$
  $Q = 1.21 \times 12 \times 8300 = 120{,}500$ W
- From Standard Heater Table, 105 kW would result in 10.5°C temperature increase or 126 kW would result in 12.5°C temperature increase.

With either selection a four-step control is feasible. Non-standard heater size and non-standard heater steps are also available. Please consult *Carrier* office for non-standard heater requirements.

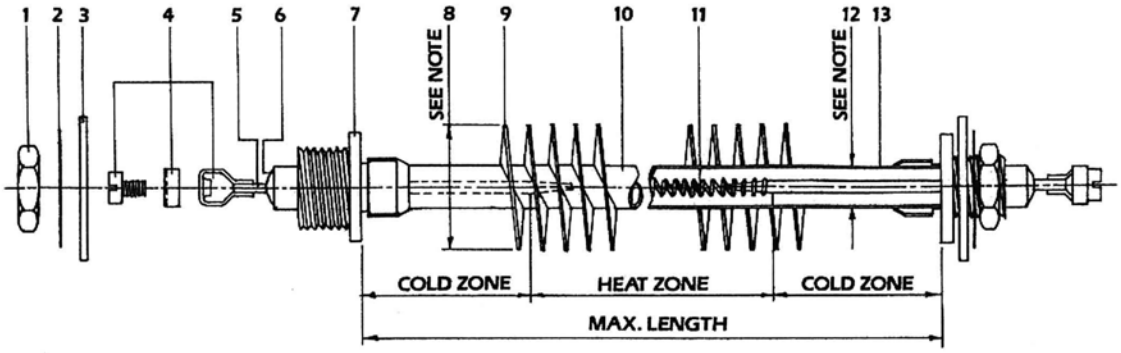
**FINNED CLOSED WITH OTHER SUPPLY VOLTAGES**

If standard heaters are used with non-standard power supplies, there will be an incidence on the effective capacity of the heaters in virtue of the law $P = U^2/R$. List below the variation of power supplies and incidence.

| Supply Voltage at 3 phase. | Incidence |
|---|---|
| 220 | Under power 10 % |
| 230 | Power = Nominal |
| 240 | Over power 9 % |
| 380 | Under power 10 % |
| 415 | Over power 7.5 % |
| 440 | Under power 10 % |
| 460 | Power = Nominal |
| 480 | Under power 10 % |

Heater elements are wired and connected depending to the supply voltage and number of supply phases. Addition to this each supply voltage will require specific minimum element in respective group. For non-standard heater application please consult *Carrier* office.

# Closed Type Heater




1. Brass 3/8" BSP Locknut.
2. Optional identification disc.
3. Galvanised washer.
4. Stainless steel terminal, includes screw and washer.
5. Steel terminal pin.
6. High quality seal to prevent ingress of moisture.
7. Zinc plated steel press on bush, 3/8" BSP complete with locknut and washer.
8. Outside fin diameter (a) 11mm Series = 31.75mm O.D.
   (b) 8mm Series = 22mm O.D.
9. Continuous wound steel fins assure excellent heat transfer and help prevent fin vibration at high air velocities. (a) Fins 2 turns per cm (10mm ø Series)
   (b) Fins 2 turns per cm (8mm ø Series)
10. Element coated in high temperature Alum paint, cured at high temperatures to prevent hazardous fumes when energised.
11. Nickel chrome helix wire
12. (a) Heavy duty steel tube (11mm ø Series)
    (b) Heavy duty steel tube (8mm ø Series)
13. Stamped Cat. No., wattage and voltage.
14 Cold Zone: Standard length 75mm.
15 Max. Length:Based on straight length (a) 11mm Series = 6500mm.
   (b) 8mm Series = 6300mm.
16 Maximum operating temperature of standard elements = 100°C in air. For special applications where higher operating temperatures are required please contact the manufacturer.

**Standard Heater for Carrier 39F AHU 400V/ 3 phase.**

| Model | Heating power (kW) | steps |
|---|---|---|
| 220 | 6 | 3 - 3 |
| | 6 | 6 |
| | 12 | 6 - 6 |
| | 18 | 6 - 6 - 6 |
| | 24 | 6 - 6 - 12 |
| 230 | 9 | 9 |
| | 18 | 9 - 9 |
| | 27 | 9 - 9 - 9 |
| | 36 | 9 - 9 - 18 |
| | 54 | 9 - 9 - 18 - 18 |
| | 63 | 9 - 18 - 18 - 18 |
| 240 | 12 | 12 |
| | 24 | 12 - 12 |
| | 36 | 12 - 12 - 12 |
| | 48 | 12 - 12 - 24 |
| | 60 | 3 X 12 - 24 |
| 330 | 9 | 9 |
| | 18 | 9 - 9 |
| | 27 | 9 - 9 - 9 |
| | 36 | 9 - 9 - 18 |
| | 45 | 9 - 9 - 9 - 18 |
| | 54 | 9 - 9 - 18 - 18 |
| | 72 | 4 X 18 |
| 340 | 15 | 15 |
| | 30 | 15 - 15 |
| | 45 | 15 - 15 - 15 |
| | 60 | 15 - 15 - 30 |
| | 75 | 3 X 15 - 30 |
| | 90 | 15 - 15 - 30 - 30 |
| | 105 | 15 - 15 - 30 - 45 |
| | 120 | 15 - 30 - 30 - 45 |
| 350 | 30 | 15 - 15 |
| | 45 | 15 - 15 - 15 |
| | 60 | 15 - 15 - 30 |
| | 75 | 3 X 15 - 30 |
| | 90 | 15 - 15 - 30 - 30 |
| | 135 | 3 X 15 - 30 - 30 |
| 360<br>370<br>380 | 21 | 21 |
| | 42 | 21 - 21 |
| | 63 | 21 - 21 - 21 |
| | 84 | 21 - 21 - 42 |
| | 105 | 21 - 21 - 21 - 42 |
| | 147 | 21 - 21 - 42 - 63 |
| | 168 | 21 - 21 - 42 - 84 |
| 440 | 15 | 15 |
| | 30 | 15 - 15 |
| | 45 | 15 - 15 - 15 |
| | 60 | 15 - 15 - 30 |
| | 75 | 3 X 15 - 30 |
| | 90 | 15 - 15 - 30 - 30 |
| | 105 | 15 - 15 - 30 - 45 |
| | 120 | 15 - 15 - 30 - 60 |
| | 135 | 15 - 15 - 15 - 30 - 60 |
| | 165 | 15 - 30 - 60 - 60 |

| Model | Heating power (kW) | steps |
|---|---|---|
| 450 | 30 | 15 - 15 |
| | 45 | 15 - 15 - 15 |
| | 60 | 15 - 15 - 30 |
| | 75 | 3 X 15 - 30 |
| | 90 | 15 - 15 - 30 - 30 |
| | 105 | 15 - 15 - 30 - 45 |
| | 150 | 15 - 15 - 30 - 30 - 60 |
| | 180 | 4 X 45 |
| 460<br>470<br>480 | 21 | 21 |
| | 63 | 21 - 21 - 21 |
| | 84 | 21 - 21 - 42 |
| | 105 | 21 - 21 - 21 - 42 |
| | 126 | 21 - 21 - 42 - 42 |
| | 147 | 21 - 21 -42 - 63 |
| | 189 | 3 X 21 - 42 - 84 |
| 550 | 60 | 15 - 15 - 30 |
| | 75 | 3 X 15 - 30 |
| | 90 | 15 - 15 - 30 - 30 |
| | 105 | 15 - 15 - 30 - 45 |
| | 120 | 15 - 15 - 30 - 60 |
| | 135 | 15 - 15 - 15 - 30 - 60 |
| 560<br>570<br>580 | 42 | 21 - 21 |
| | 63 | 21 - 21 - 21 |
| | 84 | 21 - 21 - 42 |
| | 105 | 21 - 21 - 21 - 42 |
| | 126 | 21 - 21 - 42 - 42 |
| | 147 | 21 - 21 - 42 - 63 |
| | 168 | 21 - 21 - 42 - 84 |
| | 189 | 3 X 21 - 42 - 84 |
| 660<br>670<br>680 | 63 | 21 - 21 - 21 |
| | 105 | 21 - 21 - 21 - 42 |
| | 126 | 21 - 21 - 42 - 42 |
| | 147 | 21 - 21 - 42 - 63 |
| | 168 | 21 - 21 - 42 - 84 |
| | 189 | 3 X 21 - 42 - 84 |
| | 210 | 21 - 21 - 42 - 42 - 84 |
| | 231 | 21 - 21 - 42 - 63 - 84 |
| | 252 | 21 - 21 - 42 - 63 - 105 |
| 770<br>780 | 147 | 21 - 21 - 42 - 63 |
| | 168 | 21 - 21 - 42 - 84 |
| | 189 | 3 X 21 - 42 - 84 |
| | 210 | 21 - 21 - 42 - 42 - 84 |
| | 231 | 21 - 21 - 42 - 63 - 84 |
| | 252 | 21 - 21 - 42 - 63 - 105 |
| | 273 | 21 - 21 - 42 - 84 - 105 |
| | 294 | 21 - 21 - 42 - 84 - 126 |
| 7100 | 189 | 3 X 21 - 42 - 84 |
| | 210 | 21 - 21 - 42 - 42 - 84 |
| | 231 | 21 - 21 - 42 - 63 - 84 |
| | 252 | 21 - 21 - 42 - 63 - 105 |
| | 273 | 21 - 21 - 42 - 84 - 105 |
| | 294 | 21 - 21 - 42 - 84 - 126 |

*Standard Heater - heating powers and number of steps*

# Heat Recovering System

## GENERAL

The recovery of thermal energy from exhaust air will increase the overall efficiency of an air conditioning system.

$$E\% = \frac{\text{Recovered heat}}{\text{Recoverable heat}} \times 100$$

The heat recover heat is dependent on the prevailing external conditions.

The amount of latent heat recovered is normally small compared with the sensible heat recovery and is therefore not taken into account in above equation. However, in mid-winter it is possible that condensation in the exhaust air circuit might occur.

The three types of heat recovery units are offered:

1. Plate recouperators: single unit, standard and high efficiency
2. Run around coil: flexible, simple installation and minimal space requirement
3. Heat wheel

## PLATE RECOUPERATORS

### Description

*Operation*

The design provides for two airflow's to pass crossways between the heat exchanger plates. The colder air when passing through the unit absorbs heat contained in the outgoing airflow. The two airflow is completely isolated by the sealed construction of the heat exchanger, which is designed for sensible heat transfer only. Neither dust nor odors are transmitted.

*Construction*

A group of aluminum plates are located diagonally in the recouperator casing which is formed of galvanized sheets riveted together. Silicone seal assures complete air tightness. The lower part of the casing forms a watertight pan to recover possible condensate.

*Models*

Three are offered of which two are of different efficiency due to different plate dimensions:
ES: Standard Efficiency
EH: High Efficiency
EP: With an air bypass (BP)

### Recommendations

*Limitations*

The heat recovery units with aluminum plates can be used for:

- temperatures up to 150°C
- a maximum pressure differential of up to 1000 Pa
- a non corrosive atmosphere

*Condensation*

Depending on the operating conditions, the exhaust air might be cooled below its dewpoint with resultant condensation. A condensate discharge must therefore be provided on the exhaust airside.

*Freeze-up*

Direct intake of sub-zero air into the unit might cause freezing of the exchanger. The temperature at which freezing might occur depends on the temperature and the relative humidity of the exhaust air as well as on the proportion of outside air to exhaust air.

Freezing can be prevented by increasing the outside air temperature either with preheat or by recycling a part of the exhaust air or by bypassing a part of the outside air.

### Installation

The casing of the independent vertical heat recovery unit is connected to other components of the air handling unit. As with all air to air heat exchangers, plate recouperators give their best efficiency when they are situated at the suction side of the fan.

The supply and exhaust fans should be wired for simultaneous operation.

The condensate discharge tubing (PVC 32 mm) is connected at the bottom of the pan and passed through a lateral opening in the unit casing for connection to a U-trap and discharge.

Available for unit size of 4-module height and below with airflow not exceeding 15 000 $m^3$/hr.

## RUN AROUND COILS

Two coils, the one located in the exhaust air stream, the other in the supply air stream is interconnected with a pump in a closed circuit.

Heat passes from the hot exhaust air to the cold water in the tubes of the heat pick-up coil. The pump then passes this warm water to the heat rejection coil where the heat passes into the cold supply air thus cooling the water and warming the air. Cold water returns to the heat pick-up coil and the cycle is repeated.

Selection of the coils is made from 39F computer selection software and based on the following data:

- air handling unit size
- supply air and exhaust air quantities, temperatures and humidities
- glycol concentration (if used)

*Advantages*

- two completely separate airflow
- flexible duct arrangement
- simple installation
- great reliability
- low initial cost
- simple maintenance

**HEAT WHEEL**

ASHRAE Standard 62-1989 that recommended level of outside air brought into buildings has been increased. This imposes much higher latent and sensible loads on cooling and heating equipment. Heat wheel is designed to recovers total energy (sensible and latent) to meets the requirements of indoor Air Quality (IAQ), humidity control and to save energy.

The wheel made of aluminum heat storing matrix and with galvanized casing. The wheel is positioned in 39F Air Handling Unit so that it is divided into two half moon sections. Stale air from the conditioned space is exhausted through one half while outdoor air is drawn through the other half in the counter flow pattern. At the same time wheel is rotated slowly.

Sensible heat is transferred as the metallic substrate picks up and stores heat from the warmer air stream and gives it up to the cooler section.

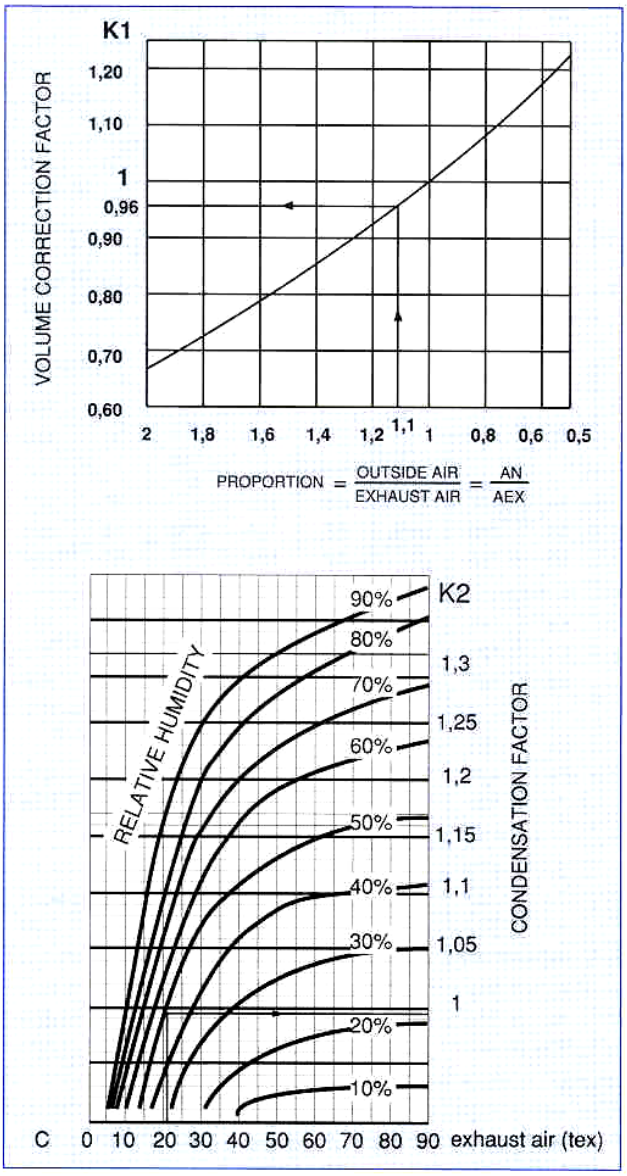
Latent heat is transferred as the synthesized metallic substrate condenses moisture from the air stream that has the higher humidity ratio through adsorption (with a simultaneous release of heat) and releases of moisture through evaporation (and heat pick-up) into the air stream that has a lower humidity ratio.

Selection detail is made from 39F computer selection software. Further inquiries please contact *Carrier* office.

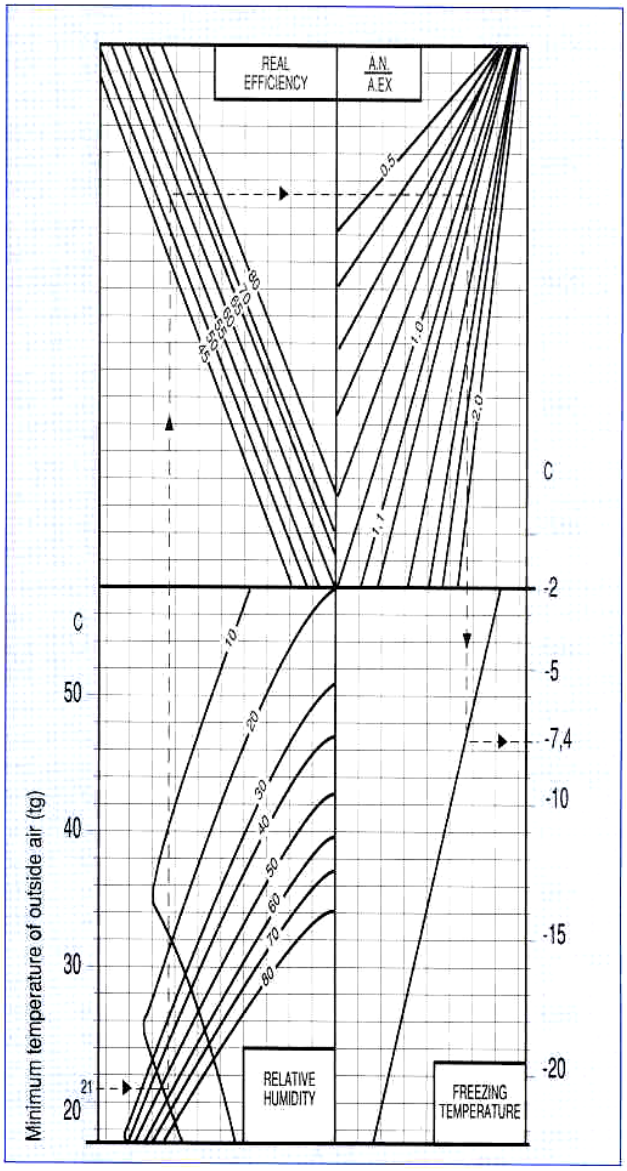
| Unit size 39F | | COIL FACE VELOCITY | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1.5 m/s | | | 2.6 m/s | | | 2.9 m/s | | | 3.15 m/s | | | 4.5 m/s | | |
| | | Volume (l/s) | Effic. (%) | dP (Pa) | Volume (l/s) | Effic. (%) | dP (Pa) | Volume (l/s) | Effic. (%) | dP (Pa) | Volume (l/s) | Effic. (%) | dP (Pa) | Volume (l/s) | Effic. (%) | dP (Pa) |
| | ES | | 56 | 80 | | 51 | 150 | | 50 | 170 | | 49 | 200 | | - | - |
| 220 | EH | 290 | 61 | 60 | 500 | 54 | 110 | 550 | 54 | 130 | 600 | 53 | 140 | 850 | 50 | 230 |
| | EP | | 61 | 60 | | 54 | 120 | | 53 | 140 | | 53 | 160 | | 51 | 250 |
| | ES | | 55 | 90 | | 50 | 170 | | 49 | 200 | | 48 | 250 | | - | - |
| 230 | EH | 500 | 59 | 70 | 900 | 53 | 130 | 1000 | 53 | 150 | 1100 | 52 | 170 | 1650 | 49 | 280 |
| | EP | | 60 | 70 | | 54 | 130 | | 53 | 150 | | 52 | 170 | | 50 | 290 |
| | ES | | 55 | 90 | | 50 | 180 | | 49 | 210 | | 49 | 240 | | - | - |
| 240 | EH | 720 | 59 | 70 | 1280 | 53 | 135 | 1400 | 52 | 150 | 1500 | 51 | 170 | 2150 | 50 | 290 |
| | EP | | 60 | 70 | | 55 | 140 | | 54 | 155 | | 53 | 175 | | 51 | 310 |
| | ES | | 57 | 90 | | 52 | 190 | | 51 | 220 | | 51 | 250 | | - | - |
| 330 | EH | 800 | 60 | 70 | 1450 | 55 | 130 | 1600 | 55 | 150 | 1750 | 54 | 160 | 2500 | 52 | 270 |
| | EP | | 63 | 70 | | 58 | 130 | | 57 | 150 | | 57 | 170 | | 56 | 285 |
| | ES | | 60 | 70 | | 55 | 130 | | 55 | 150 | | 54 | 170 | | 52 | 290 |
| 340 | EH | 1200 | 65 | 50 | 2050 | 60 | 100 | 2250 | 59 | 110 | 2000 | 58 | 130 | 3550 | 56 | 200 |
| | EP | | 65 | 50 | | 60 | 105 | | 60 | 110 | | 59 | 130 | | 57 | 220 |
| | ES | | 60 | 70 | | 55 | 140 | | 54 | 165 | | 53 | 190 | | 52 | 330 |
| 350 | EH | 1550 | 65 | 50 | 2700 | 59 | 110 | 3050 | 59 | 120 | 3300 | 58 | 130 | 4760 | 56 | 220 |
| | EP | | 65 | 50 | | 60 | 110 | | 59 | 125 | | 59 | 135 | | 57 | 220 |
| | ES | | 60 | 70 | | 55 | 150 | | 54 | 165 | | 53 | 190 | | 52 | 330 |
| 360 | EH | 1900 | 65 | 50 | 3300 | 59 | 110 | 3700 | 59 | 125 | 4000 | 58 | 130 | 5750 | 56 | 220 |
| | EP | | 65 | 50 | | 60 | 110 | | 59 | 125 | | 59 | 130 | | 57 | 220 |
| | ES | | 60 | 70 | | 55 | 150 | | 54 | 165 | | 53 | 190 | | - | - |
| 370 | EH | 2300 | 65 | 50 | 3950 | 59 | 110 | 4400 | 59 | 120 | 4800 | 58 | 140 | 6850 | 56 | 230 |
| | EP | | 65 | 55 | | 60 | 110 | | 59 | 120 | | 59 | 135 | | 57 | 230 |
| | ES | | 63 | 70 | | 57 | 150 | | 57 | 170 | | 56 | 190 | | - | - |
| 440 | EH | 1625 | 65 | 50 | 2800 | 60 | 110 | 3200 | 59 | 130 | 3400 | 58 | 145 | 4900 | 57 | 250 |
| | EP | | 66 | 60 | | 63 | 115 | | 62 | 130 | | 61 | 150 | | 60 | 250 |
| | ES | | 61 | 90 | | 57 | 150 | | 56 | 185 | | 56 | 210 | | - | - |
| 450 | EH | 2200 | 63 | 70 | 3800 | 59 | 130 | 4200 | 59 | 145 | 4600 | 58 | 160 | 6550 | 57 | 260 |
| | EP | | 66 | 70 | | 62 | 130 | | 62 | 140 | | 61 | 150 | | 60 | 260 |
| | ES | | 61 | 90 | | 57 | 150 | | 56 | 185 | | 56 | 210 | | - | - |
| 460 | EH | 2650 | 63 | 70 | 4600 | 59 | 130 | 5150 | 58 | 145 | 5500 | 58 | 160 | 7950 | 57 | 270 |
| | EP | | 66 | 65 | | 62 | 120 | | 62 | 140 | | 61 | 150 | | 60 | 250 |

**ES:** *standard efficiency*
**EH:** *high efficiency*
**EP:** *bypass model*

**Correction factors for plate recouperators**




**Freezing limit for plate recouperators**



# Humidifiers

## GENERAL

Air humidification can be obtained by:
- adiabatic process (constant heat)
- isothermal process (constant temperature)

**Adiabatic Humidification** (with water spray)
At constant enthalpy part of the sensible heat content of the air is converted into latent heat of evaporation. The efficiency of that process is defined by:

$$E\% = \frac{Xl - Xe}{Xs - Xe} \times 100$$

Xl = quantity of water vapor in ht e air leaving the humidifier (g/kg)

Xe = quantity of water vapor in the air entering the humidifier (g/kg)

Xs = quantity of water vapor at saturation in the air entering the humidifier (g/kg)

**Isothermal Humidification** (steam injection)
At constant temperature the amount of water in the air is increased and with it the enthalpy of the air.

## DESCRIPTION

- The adiabatic or spray humidifier used with the 39F units consists of:
- Painted and bolted galvanized sheet metal panels (welding eliminated) and internally coated for water tightness.
- Water sump with level control and furnished with the following openings:
  - drain
  - overflow
  - water supply with float valve
  - suction connection with screen
- One or two rows of galvanized stand pipes with atomizing plastic spay nozzles providing a fine water mist for maximum efficiency (spray nozzles easily removed for maintenance)
- Vertical galvanized steel eliminator plates specially formed, and installed upstream and downstream to provide droplet elimination
- Porthole for assembly inspection (not furnished on sizes 220, 230 and 240)
- Inspection – maintenance door
- Recirculating centrifugal pump, field supply & field mounted

Note: units are supplied single skin, un-lagged.

*Two models of humidifiers are available*:

1. **Short humidifier** (medium efficiency)
   With one row of spray nozzles directed against the airflow. Maximum efficiency: 79% at 2.2 m/s coil face velocity. Overall length: 4 modules = 1310 mm.
2. **Long humidifier** (high efficiency)
   Two rows of spray nozzles directed against the airflow. Maximum efficiency: 84% at 2.2 m/s coil face velocity. Overall length: 6 modules = 1940 mm.

## RECOMMENDATIONS

The following condition must be met:
- electrical interlock between pump and fan motor
- supply of filtered and treated water (pH = 7)
- continuous bleed-off to prevent salt accumulation in sump
- a drain U-trap twice the height of the fan static pressure
- adequate protection against freezing

## INSTALLATION

The humidifier forms an independent section to be connected to the other unit sections by using the accessories fixings supplied with the unit for this purpose.

Since the sump is located at the bottom of the humidifier and below the airflow, support legs for the other sections of the air handling units have to be provided to maintain uniform level. These support legs are factory supplied as optional accessories.

The recirculating pump must be field connected and located at the same height as the sump. A free space of 600 mm for this installation is required.

## SELECTION

*Example*:

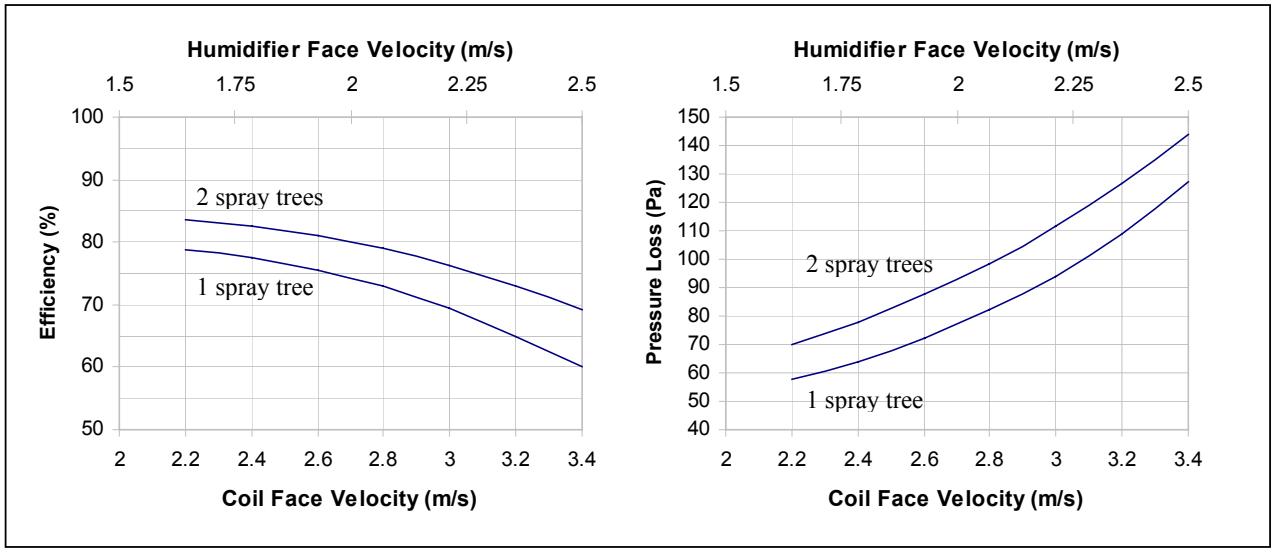
Unit 39FD 570, entering air 7500 l/s at 2.7 m/s (standard coil face velocity), entering air at 25°C and Xe = 3 g/kg water vapor.

- Required; leaving air Xl = 7.5 g/kg
- From the psychrometric chart read ; saturation of entering air Xs = 8.5 g/kg
- Efficiency $E\% = \frac{7.5 - 3}{8.5 - 3} \times 100 = 82\%$
- From humidifier efficiency curve at 2.7 m/s

  For one spray tree: E = 74%
  For two spray trees: E = 80%

- Two spray trees humidifier satisfies the requirements

The actual leaving air conditioners are
Xl = 0.80 x (8.5 – 3.0) +3 = 7.4 g/kg
Leaving air temperature: 14.5°C with 75% r.h.

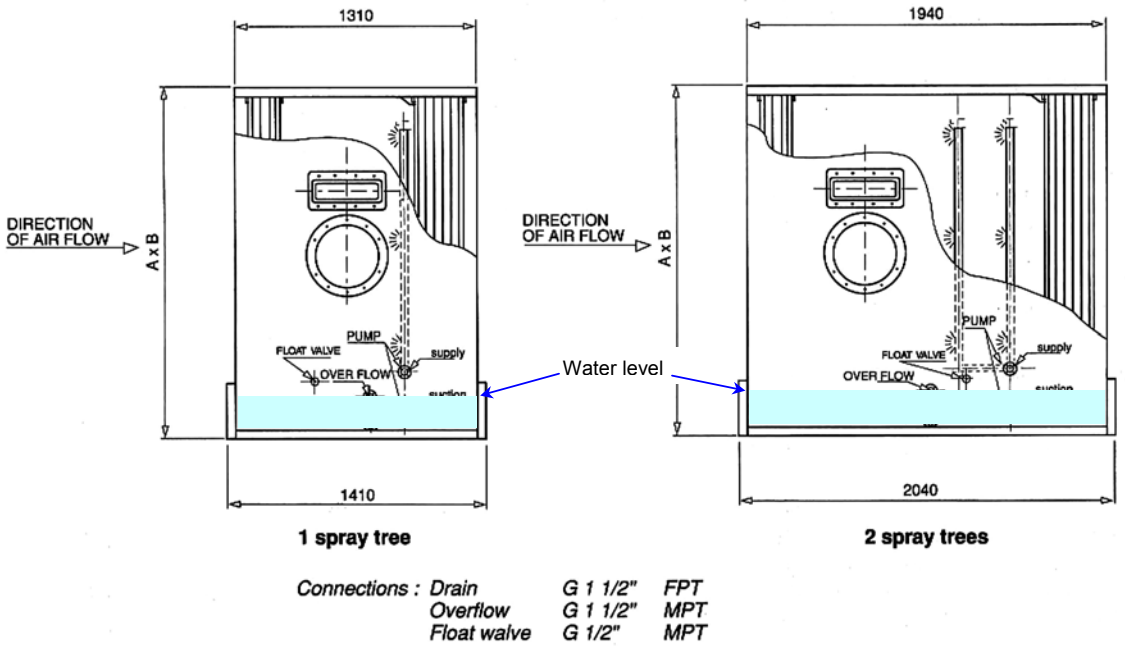



*Efficiencies and airside pressure losses through humidifiers*

## Weight of humidifiers and water charges

| Unit size 39F | 1 spray tree | | 2 spray tree | |
|---|---|---|---|---|
| | Weight (kg) | Water charge (kg) | Weight (kg) | Water charge (kg) |
| **220** | 170 | 140 | 240 | 210 |
| **230** | 205 | 215 | 295 | 320 |
| **240** | 220 | 290 | 310 | 430 |
| **330** | 230 | 215 | 330 | 320 |
| **340** | 260 | 290 | 375 | 430 |
| **350** | 315 | 370 | 460 | 550 |
| **360** | 365 | 430 | 535 | 720 |
| **370** | 410 | 520 | 605 | 770 |
| **440** | 335 | 290 | 485 | 430 |
| **450** | 375 | 370 | 550 | 550 |
| **460** | 430 | 430 | 635 | 720 |
| **470** | 490 | 520 | 720 | 770 |
| **480** | 545 | 600 | 810 | 885 |
| **550** | 425 | 370 | 640 | 550 |
| **560** | 490 | 430 | 730 | 720 |
| **570** | 560 | 520 | 810 | 770 |
| **580** | 620 | 600 | 930 | 885 |
| **660** | 560 | 430 | 835 | 720 |
| **670** | 635 | 520 | 950 | 770 |
| **680** | 690 | 600 | 1065 | 885 |
| **770** | 705 | 520 | 1065 | 770 |
| **780** | 790 | 600 | 1200 | 885 |
| **7100** | 955 | 750 | 1450 | 1110 |

## Dimensional drawing




*Connections : Drain G 1 1/2" FPT*
*Overflow G 1 1/2" MPT*
*Float walve G 1/2" MPT*

## Physical data

| Unit size 39F | A (mm) | B (mm) | Max air volume l/s | 1 tree counter flow | | | | 2 trees counter flow | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Recirculated water volume l/s | Pump kW | Suction dia | Supply dia | Recirculated water volume l/s | Pump kW | Suction dia | Supply dia |
| **220** | | 680 | 650 | 0.24 | 0.55 | 1" | 1" | 0.32 | 0.55 | 1" | 1" |
| **230** | 995 | 995 | 1150 | 0.42 | 0.55 | 1" | 1" | 0.72 | 0.55 | 1" | 1" |
| **240** | | 1310 | 1650 | 0.58 | 0.55 | 1" | 1" | 1.01 | 0.75 | 1" 1/4 | 1" 1/4 |
| **330** | | 995 | 1900 | 0.68 | 0.55 | 1" | 1" | 1.18 | 0.75 | 1" 1/4 | 1" 1/4 |
| **340** | | 1310 | 2650 | 0.94 | 0.75 | 1" 1/4 | 1" 1/4 | 1.65 | 0.75 | 1" 1/4 | 1" 1/4 |
| **350** | 1310 | 1625 | 3550 | 1.32 | 0.75 | 1" 1/4 | 1" 1/4 | 2.40 | 1.5 | 2" | 2" |
| **360** | | 1940 | 4350 | 1.51 | 0.75 | 1" 1/4 | 1" 1/4 | 2.67 | 1.5 | 2" | 2" |
| **370** | | 2255 | 5150 | 1.83 | 1.5 | 2" | 2" | 3.19 | 1.5 | 2" | 2" |
| **440** | | 1310 | 3700 | 1.31 | 0.75 | 1" 1/4 | 1" 1/4 | 2.28 | 1.5 | 2" | 2" |
| **450** | | 1625 | 4950 | | 0.75 | 1" 1/4 | 1" 1/4 | 3.06 | 1.5 | 2" | 2" |
| **460** | 1625 | 1940 | 6000 | 1.13 | 1.5 | 2" | 2" | 3.72 | 4 | 2" | 2" |
| **470** | | 2255 | 7150 | 2.54 | 1.5 | 2" | 2" | 4.44 | 4 | 2" | 2" |
| **480** | | 2570 | 8300 | 2.94 | 1.5 | 2" | 2" | 5.15 | 4 | 2" | 2" |
| **550** | | 1625 | 6600 | 2.33 | 1.5 | 2" | 2" | 4.07 | 4 | 2" | 2" |
| **560** | 1940 | 1940 | 8000 | 2.83 | 1.5 | 2" | 2" | 4.96 | 4 | 2" | 2" |
| **570** | | 2255 | 9550 | 3.39 | 4 | 2" | 2" | 5.22 | 4 | 2" | 2" |
| **580** | | 2570 | 11083 | 3.92 | 4 | 2" | 2" | 6.88 | 3 | 2" 1/2 | 2" |
| **660** | | 1940 | 9650 | 3.43 | 4 | 2" | 2" | 6.00 | 4 | 2" | 2" |
| **670** | 2255 | 2255 | 11550 | 4.08 | 4 | 2" | 2" | 7.14 | 3 | 2" 1/2 | 2" |
| **680** | | 2570 | 13400 | 4.72 | 4 | 2" | 2" | 8.31 | 3 | 2" 1/2 | 2" |
| **770** | | 2255 | 13550 | 4.79 | 4 | 2" | 2" | 8.38 | 3 | 2" 1/2 | 2" |
| **780** | 2570 | 2570 | 15700 | 5.50 | 4 | 2" | 2" | 9.72 | 3 | 2" 1/2 | 2" |
| **7100** | | 3200 | 20100 | 4.95 | 3 | 2" 1/2 | 2" | 12.60 | 3 | 2" 1/2 | 2" |

# Sound Attenuators

**GENERAL**

Where a significant reduction to fan noise is required attenuators can be provided.

**DESCRIPTION**

Sound absorption is achieved by installing mineral wool splitters (non-combustible class MO fire code), fixed in galvanized steel frames and mounted parallel to the airflow.

Various splitter lengths are available to provide a range of attenuator performances.

The sides exposed to the air stream are covered with a glass fiber scrim to avoid erosion to the mineral wool by the air stream.

The standard thickness of the splitters is 200 mm.

**RECOMMENDATIONS**

Following limits are to be observed

- Maximum air velocity between panels: 20 m/s
- Maximum temperature: 100°C

**INSTALLATION**

The splitters are installed within the 39F unit and form an integral part of it. They can be located in the discharge or inlet sides of supply or return fan.

**DIMENSIONS**

The height is determined by the height of the air handling unit.

The amount of sound absorption depends on the splitter length.

The length of the splitter casing takes into the account the space required for uniform airflow after leaving the attenuator splitters.

**MANUAL PRESELECTION**

Deduct silencer sound attenuation figures (table below) from fan sound power spectrum to arrive at sound level leaving the attenuator.

Exact calculations are made by computer program.

| Octave band | 63Hz | 125Hz | 250Hz | 500Hz | 1kHz | 2kHz | 4kHz | 8kHz |
|---|---|---|---|---|---|---|---|---|
| **Forward curve** | 6 | 7 | 10 | 12 | 13 | 15 | 19 | 23 |
| **Backward curve** | 4 | 6 | 7 | 9 | 11 | 15 | 19 | 23 |

*Deduct values (dB) from overall sound level figures obtained from fan curves to arrive at fan sound power spectrum*

| Splitter length | 63Hz | 125Hz | 250Hz | 500Hz | 1kHz | 2kHz | 4kHz | 8kHz |
|---|---|---|---|---|---|---|---|---|
| **3 modules** | 5 | 10 | 16 | 24 | 30 | 33 | 26 | 18 |
| **4 modules** | 6 | 11 | 22 | 30 | 37 | 40 | 34 | 23 |
| **5 modules** | 6 | 13 | 28 | 38 | 42 | 45 | 40 | 27 |
| **6 modules** | 7 | 16 | 32 | 44 | 48 | 50 | 45 | 30 |

*Deduct values (dB) from fan sound power spectrum to arrive at sound level leaving attenuator*

# Application Guide

Parts of the considerations while selecting an AHU are the space area available for installation and the unit application. This limitation will determine the unit size and unit configuration.

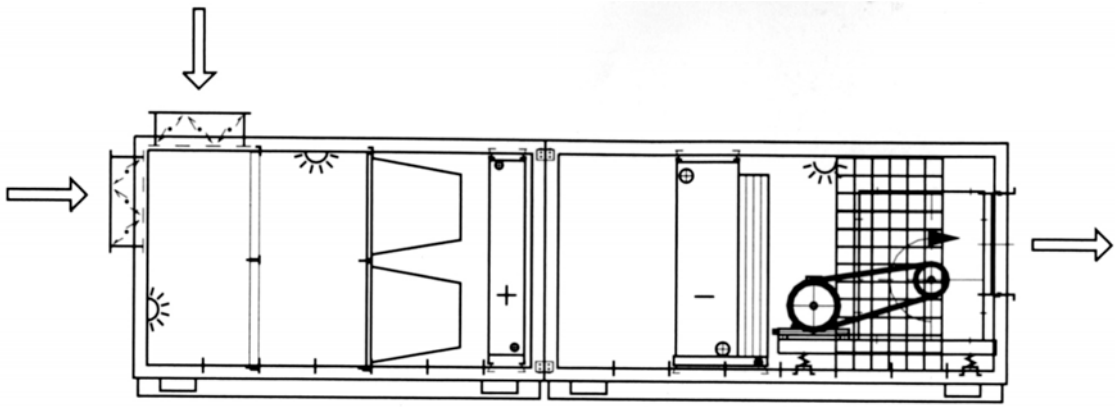
**SERVICE CLEARANCE**

Allow adequate clearance for servicing and maintenance access (filter and coil removal, motor and fan shaft servicing). Avoid any piping, conduit or ductwork that might obstruct the service door access and space. For sufficient clearance space guideline please refer to the Installation Operating Manual.

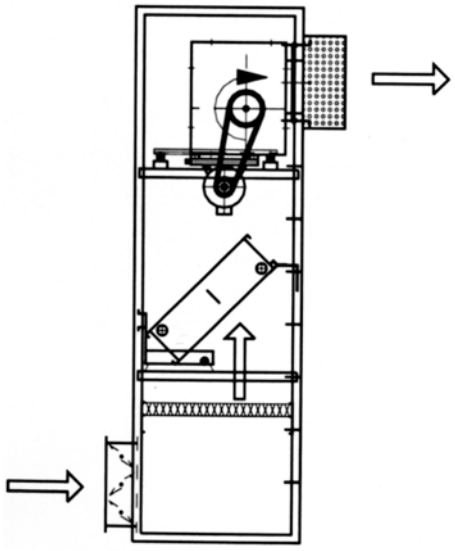
**CONDENSATE DRAIN**

Install a trapped condensate drain line at appropriate location to avoid back flow of condensate water and to ensure proper drainage. Guide line of U-trap installation as per the operating manual.

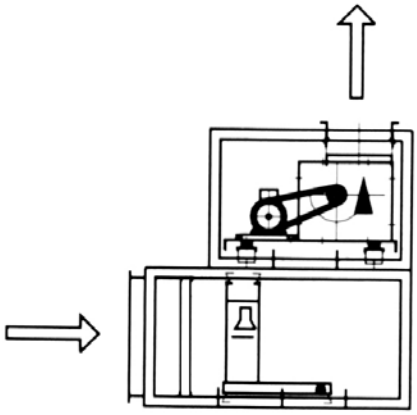
**UNIT CONFIGURATIONS**



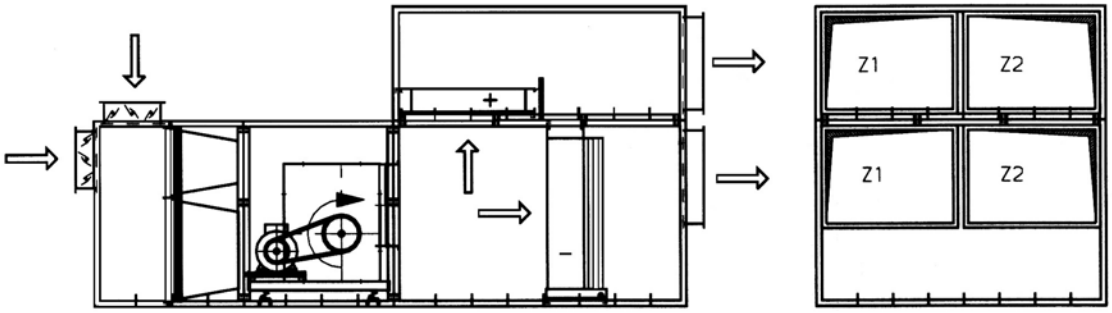
**Horizontal Draw Through Unit**



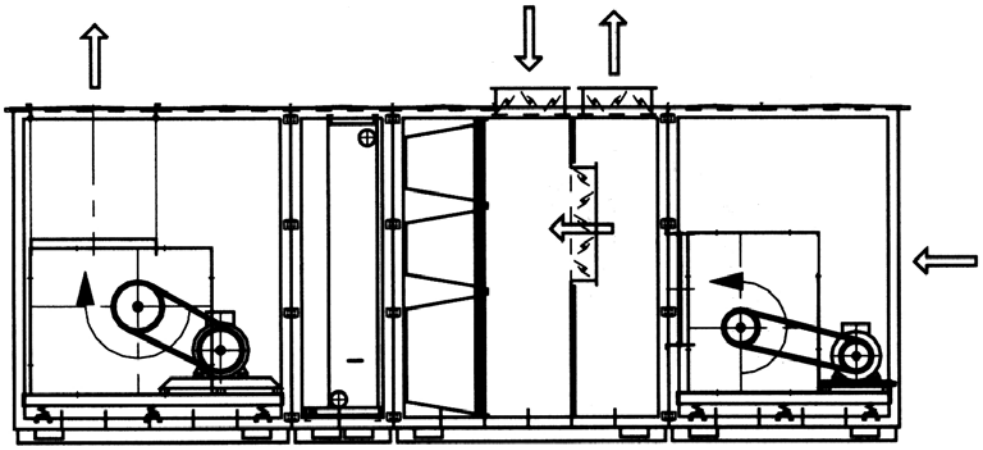
**Vertical Draw Through I-unit**



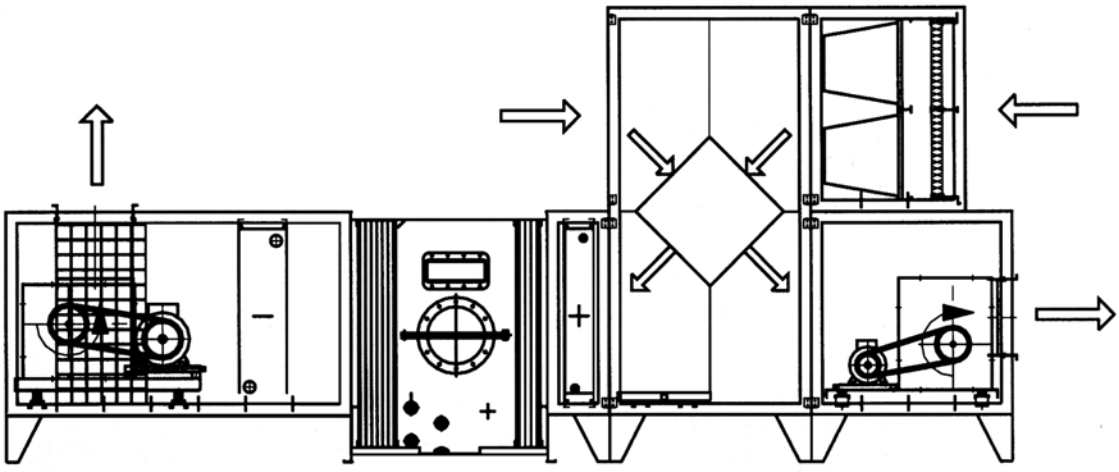
**Vertical Draw Through L-unit**



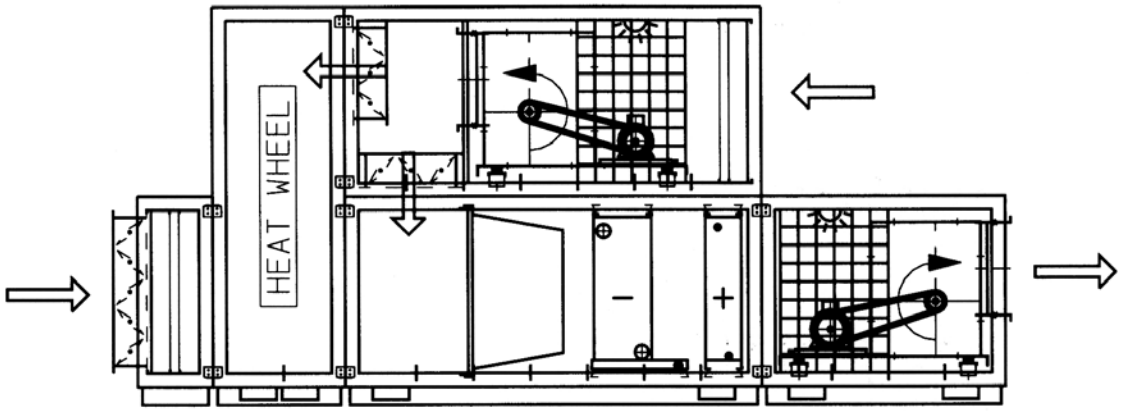

**Multizone Unit** **(Front view)**



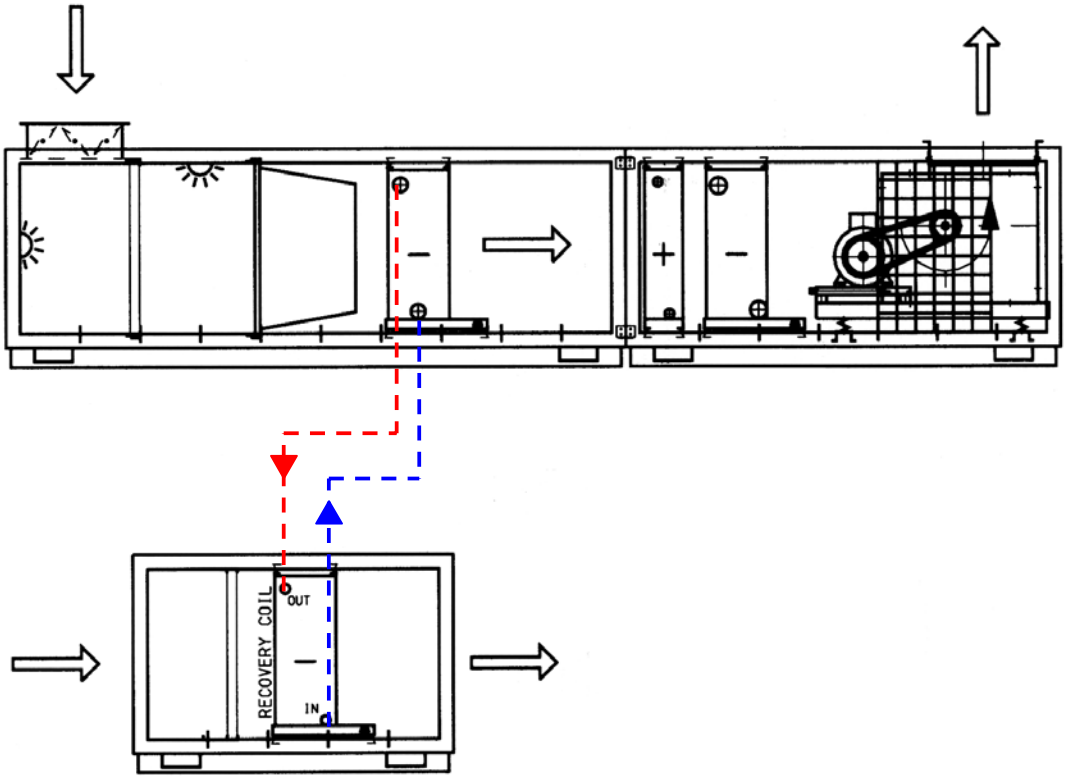
**Unit with Return and Supply Fan**



**Unit with Air Washer and Plate Recouperator**




**Unit with Heat Wheel**




**Unit with Recovery Coil**

# Options

## A. CASING

1. **Galvanized and painted steel roofing**
   The roof sheets are cross-braked for added stiffness and to facilitate water runoff and are overhung on all sides.

   Slip joints assure water tightness between adjacent sheet.

2. **Sub base 100 mm high, galvanized and painted**
   39F unit sections are self supporting and do not rely on a base for additional stiffening. However, bases are sometimes required to provide sufficient height for a U-trap below the cooling coil drain pan or to raise units from roof slab in external locations.

3. **Air inlet hood**
   In galvanized, painted sheet metal sized and sloped to avoid water entrapment.

   A fine wiremesh bird screen is provided.

4. **Air discharge hood**
   In galvanized, painted sheet metal, designed to prevent ingress of water.

   A fine wiremesh bird screen is provided.

5. **Flexible connections**
   For specifications calling for total unit to be vibration isolated.

   In fabric non-flammable class M1 with connecting flanges in galvanized painted steel. Can be installed on suction and / or discharge side.

6. **Bulkhead light**
   75 watts light bulb under glass cover, with switch and a connection box all to IP 55. Wiring upon request.

7. **Inspection window**
   In strong plexiglass, 180 mm dia.

   Together with bulkhead light allows quick inspection of the inside of the casing while unit is in operation.

## B. FILTERS

1. **Pressure control**
   U-tube pressure gauge 0 to 500 Pa.

   Inclined tube pressure gauge 0 to 500 Pa. Furnished for field installation. The pressure connection tappings are factory installed.

   Differential air pressure switch adjustable from 10 to 1250 Pa.

2. **Air diffusion screen**
   For filters installed downstream from the fan discharge and to assure a uniform air distribution.

## C. HUMIDIFIERS

1. **Support feet**
   In galvanized painted sheet metal, 315 mm high, to compensate for the added height due to the humidifier sump. These feet are to be placed under the edges of all other sections.

2. **Inspection light**
   In cast iron and glass, to IP 55

## D. FANS

1. **Variable volume control**
   For variable volume systems: Inlet guide vanes (for backward curved fans) or variable speed motors (eddy current coupling, or frequency inverter control) are available.

2. **Fan drain**
   This connection is located on the bottom of the fan volute and serves to drain any condensation which might form on the inside of the fan.

3. **Inspection door**
   Available on all fan sizes, serves as access to the fans for interior inspection and cleaning of the volute and the fan impeller.

## E. MOTOR

1. **Vee belt guard**
   Made of galvanized expended steel.

2. **Variable pitch pulleys**
   Can be installed on the motor shaft and / or the fan shaft to allow fan speed variation between + or –20% for one variable pulley and + or – 50% for a pair of variable pitch pulleys. This system is limited to maximum two grooves at the pulley and the motor power of maximum 5.5 kW. Adjustment can only be made manually and when the fan is stationary.

3. **Standby motor**
   Situated opposite to the run motor and furnished with a set of belts and pulley (belts not fitted).

## F. EXPLOSION PROOF CONSTRUCTION

Applied where the possibility of flammable gasses exist. Flameproof motors and switches and fan non-spark rings can be provided. The

request for such modifications must indicate the protection classification specified.

**G. New Flexair Options**

1. **Rail mounted soft bag filter**
   Takes only two modules long including easy removal panel.

   *Notes:*
   *a. for 95% opacimetric efficiency (EU 9) available from factory with two module length filter sections.*
   *b. available from factory for the following sizes, 39FD/FX 220,230 and 240*

2. **High velocity droplet eliminators**
   Made of M1 propylen (Germany : B2)

   Allow coil face velocity up to 4m/s

   *Note:*

   *High front velocity may result in unacceptable front filter velocity (to be checked)*

3. **Frequency inverters and PTC sensors**
   For variable volume systems to match exactly fan quadratic power input curves.

4. **Coil protection against corrosion**
   To increase resistance to corrosion depending on application data, following protections are available:

   - Cu/Al + Polyal.
   - Cu/Cu coil.
   - Pre-coaed fin.

# Guide Specifications

## GENERAL

39FD/FX Series Central Station Air Handling Units are designed based on Carrier 'Moduflex' Series. The design of the Central Station Air Handling Units is based on the use of standardized modular panels and 'penta-post' construction of perimeter frames. The standard and reference for design and performances for 39FD/DX Central Station AHUs components shall conform mostly to American standard and EUROVENT Standard

Standard units configuration shall be horizontal or vertical draw-through or blow-through types.

## Part-1 Central Station AHU's Guide Specification – General

**1.01 39FD/FX Series:**
1.01.01 39FD; 25-mm panel thickness
1.01.02 39FX; 50-mm panel thickness

**1.02 Standard Size Range:**
1.02.01 23 model sizes from 220 – 7100

**1.03 Standard AHU Face Area Range:**
1.03.01 From 0.4 $m^2$ up-to 6.95 $m^2$

**1.04 Standard Airflow Range, CMH:**
1.04.01 Cooling: 1,300 – 62,550
(Up-to 78,810 with eliminator)
1.04.02 Heating: up to 90,855
1.04.03 Cool, Heat & Vent: Up-to 160,000 (special)

**1.05 Standard Heating and Cooling**
1.05.01 Cooling & Dehumanization – CWC & DXC *
1.05.02 Sensible Heating – HWC, EHTR & STC
1.05.03 Pre-cooled & Re-heat –HPE (option), RAC
1.05.04 Heat Recovering –HPE (option), HPLE, HWE
1.05.05 Humidified –SH (option), SWH

**1.06 Standard Air Management**
1.06.01 IAQ – DSC, STL, Std. Air Filter & Humidifiers
1.06.02 IAQ – Odor, chemical – ACF (option)
1.06.03 Pre-filtering up to HEPA-filtering
(EU 2 up to EU 12)
1.06.04 2 & 3-Way Air Mixing Plenum
1.06.05 Multi-zoning (option)
1.06.06 Coil by-pass (option)
1.06.07 Sound Attenuator

**1.07 Standard Air Movement**
1.07.01 DIDW fans – forward, backward and aerofoil Plenum (option)
1.07.02 VAV with VFD or IGV
1.07.03 TEFC, IP55 Fan Motor
1.07.04 Wedge Belts – SPA, SPB, SPC, SPD, SPZ
1.07.05 Fixed Pulleys – Block Web, Arm, VPP
1.07.06 Rubber & Spring Vibration Isolators
1.07.07 Single Skin Blades Damper

**1.08 Quality Assurance**
1.08.01 Manufactured in facility registered to ISO 9001:2000 / EN ISO 9001:2000 / ANSI/ASQC Q9001:2000
1.08.02 9F "Flex Air Selection Program"
1.08.03 AHU designed accordance to EN 1886 and ARI 430
1.08.04 Insulation & seal meets NFPA 90A requirements for flame spread and smoke generation.
1.08.05 Casing to withstand 500-hours salt spray exposure per ASTM B117
1.08.06 Air filters performance according to ASHRAE Standard 52-76 or EUROVENT Standard 5/6
1.08.07 Coil performance rating according to ARI 410
1.08.08 Electric Heater manufactured accordance to NEC and UL Space Heating Standard No 1996
1.08.09 Fan performance accordance to DIN or AMCA
1.07.10 Fan motor manufactured to conform to IEC Standard

* Nomenclature Page 50

## Part-2 Casing Construction (Standard)

### 2.01 General

2.01.01 39FD/FX Central Station Air Handling Unit's casing construction should be fabricated from highest grade galvanized steel.

2.01.02 Construction of panel and frames are folded to form sturdy Side/Top/Bottom panels and a rigid structure "Penta-post" frames.

2.01.03 The construction should serve thermal protection, reducing machine noise, absorbing vibration and avoiding air leakage.

2.01.04 Modular sizes of panel and penta-post should be easily assemble and reassemble.

2.01.05 The construction and material used should be environment friendly, clean and safe.

### 2.02 Penta-post Frame

2.02.01 Heavy-duty formed 'penta-post' frame is designed for rigidity and is made from highest-grade hot-dip galvanized steel with minimal spangle finish grade G90 galvanized coating according to ASTM A525 compliance to UL 465.

2.02.02 Frames shall be painted for extra protection.

### 2.03 Double Skin Panel

2.03.01 Modular panel is design to be rigid and sturdy.

2.03.02 Double skin construction and sandwiched with superior polyurethane insulation between the panel interior and exterior skins to furnish compressive strength up to 30 psi.

2.03.03 Polyurethane insulation is non-combustible, K-value 0.019 W/M.C sturdy that shall provide superior thermal resistance across the panel.

2.03.04 Panel exterior skin shall be made from highest-grade hot-dip galvanized steel, a minimal spangle grade G90 coating.

2.03.05 Panel interior skin shall be made from primed or pre-painted galvanized steel for extra protection.

### 2.04 Weather Protection

2.04.01 External surface shall be coated with highly durable heat hardened polyester based powder paint with 50 microns film thickness.

2.04.02 The paint shall conform to ASTM D-2201 and ASTM D-2092 in different condition for gloss, adhesion, impact resistance, oven backed resistance and can withstand up to 1000 hours salt spray resistance test, exceeding 500 hours according to ASTM B117.

## Part-2 Casing Construction (Standard)

### 2.04 Weather Protection

2.04.03 Casing 50-mm (39FX) shall be able to hold up-to 70% RH @ 32$^{o}$C (90$^{o}$F) ambient weather without condensation at outer skin.

### 2.05 Indoor Air Quality

2.05.01 The unit casing shall have double skin construction to avoid material insulation expose to conditioned area and to allow access in the Air-Handling unit without damaging the insulation.

### 2.06 Penta-post And Panel Seal

2.06.01 Panels and frames shall be assembled with a closed cell self-adhesive neoprene foam gasket layer installed in between them to prevent air leakage, reduce vibration noise, minimized thermal losses.

2.06.02 A closed cell self-adhesive neoprene foam gasket layer shall avoid external water to penetrate inside the unit and shall block infiltration of heat and external contamination into the conditioned space area inside the unit.

2.06.03 A closed cell self-adhesive neoprene foam gasket is with K-value of 0.04 W/M.C, flammability Class HB according to UL 94, working temperature reaching 120 $^{o}$C and maximum water absorption 5%.

### 2.07 Casing Assembly - Air Leakage

2.07.01 The construction of panels to the penta-post frames shall provide minimum air leakage Class A according to EUROVENT Standard EN 1886.

### 2.08 Access Panels

2.08.01 The fixing of panel to the penta-post frames with bolts shall provide additional access to ease mobility for major service work on large and heavy component such as coil, fan and motor.

2.08.02 Access door panel equipped with hard nylon hinges and metal lock, accessible internally and externally for safety release. This access door type shall be at the fan section and the mixing box section.

2.08.03 Quick release and totally removable access door shall be at filter section with side rail mounting.

### 2.09 Roof

2.09.01 Roof shall be install when AHU is installed in open outdoor space to flash water from top panels (optional).

## Part-2 Casing Construction (Standard)

### 2.10 Roof Curb

2.10.01 Roof curb shall be from heavy gauge (3-mm) galvanized steel (option); folded to form strong and rigid structure.

2.10.02 Standard roof curb height shall be 100-mm.

## Part-3 Air Mixing Section

### 3.01 General

3.01.01 Dampers construction should be fabricated from galvanized steel for sturdy and rigid structure. The damper construction should operate with minimal torque and minimal pressure losses.

### 3.02 Blades

3.02.01 Standard damper's blades shall be with a single skin type, made from galvanized steel and can operate in parallel or oppose blades position at minimal pressure losses.

3.02.02 Blades are equipped with rubber seal and fitted close gap within blades allowing a minimum air leak Class IV according to UL555S.

3.02.03 Side seal damper blades with air leakage Class II is available as an option.

3.02.04 Shafts are with 12 mm diameter; seated on non-corrosive bronzed or nylon bushing for less resistance, free maintenance and lowest torque.

3.02.05 Extended shaft length is provided for provision to electrical motor actuator to regulate damper's blades opening and closing.

3.02.06 Frames are made from galvanized steel, reinforced at very 1200-mm and flanged at both ends to facilitate external ductwork or sand trap louvers connection.

3.02.07 Metal linkage made from steel pushrods is installed for dampers assembled in top-rear position to allow damper to interconnected at open and closed position.

3.02.08 Damper blade's quadrant shall be assembled to guide blades opening and closing position.

3.02.09 Flexible damper connection can be assembled externally to the casing's frame to disconnect potential vibration transmitted to/from AHU/building.

3.02.10 Hinged type access door is assembled at mixing box section.

## Part-4 Air Filter Section

### 4.01 General

4.01.01 Air filter section should accommodate standard filters media to deliver clean air requirements for occupants, machines, processes, indoors environment and ventilation system.

4.01.02 All air filters with dust spot efficiency up to 98%; the performances should be tested according to ASHRAE Standard 52-76 or EUROVENT Standard 4/5.

4.01.03 Higher Dust Spot Efficiency; the filter performance should be accordance to DOP-test.

### 4.02 Preliminary Filter

4.02.01 Preliminary filter shall be made from synthetics media.

4.02.02 Synthetics filter media shall be in flat form or pleated form.

4.02.03 Aluminum filter shall be from wire mesh form.

4.02.04 Preliminary air filters (synthetics and aluminum) shall be with hard cupboard or galvanized steel frames.

4.02.05 Preliminary filters with steel frame shall be cleanable and washable.

4.02.06 Preliminary filter shall be flame resistance Class-2 according to UL 900.

4.02.07 Aluminum filter thickness shall be up to 50-mm depth, 73% Gravimetric Efficiency (Average Weight Arrestance , $A_m$ between 65 to 80) equivalent to EU2.

4.02.08 Panel synthetics filter thickness shall be 25-mm, 85% Gravimetric Efficiency (Average Weight Arrestance, $A_m$ between 80% to 90%) equivalent to EU3.

4.02.09 Pleated synthetics V-filter, pleated depth shall be up to 75-mm, 90% Gravimetric Efficiency (Average Weight Arrestance, $A_m$ at 90%) equivalent to EU4.

### 4.03 Secondary Filter

4.03.01 Soft bag filters is up to 630-mm depth synthetics bag media and supported with galvanized steel frames.

4.03.02 Soft bag filter shall be flame resistance Class-1 according to UL 900.

4.03.03 Air filter efficiency ranged up to 90% Opacimetric Efficiency or Dust Spot Efficiency (Average Atmospheric, photometric, $E_m$ up to 95; EU9).

## Part-4 Air Filter Section

### 4.04 HEPA/Absolute Filter

4.04.01 Absolute filter is up to 630-mm depth synthetics or glass fiber bag media and supported with galvanized steel or aluminum frames.

4.04.02 Absolute filter shall be flame resistance Class-1 according to UL 900.

4.04.03 Absolute air filter DOP-efficiency ranged from 95% up to 99.99% equivalent to EU10 up to EU12.

### 4.05 Filter Mounting Frame

4.05.01 Mounting frame is made from galvanized steel and filter can be accessed on to the mounting frame from "front" (front or rear access or existing frame mounting) or "slide" (side mounting) type.

4.05.02 Frame mounting frame or rails should be sealed for a minimal air leak Class F5-7 according to EUROVENT Standard EN 779.

### 4.06 Access Door

4.06.01 Filter section's access door for "Front Filter Mounting" shall be equipped with hard nylon hinges and metal lock, accessible internally and externally for safety release.

4.06.02 Filter section's access door for "Slide Rail Filter Mounting"; shall be a "quick release and totally removable access door" type.

## Part-5 Water & DX Coil Section

### 5.01 General

5.01.01 Coils shall be of the cartridge type.

5.01.02 Coils are mounted on a condensate drain pan (for cooling coil) with a slide in-out coil track so that the complete assembly is wholly removable for easy maintenance.

5.01.03 Coil shall be manufactured according to ANSI or DIN Standard and coils performance shall be rated according to ARI 410.

### 5.02 Coil Construction

5.02.01 Standard coil fins material shall be aluminum or copper or pre-coated aluminum. Aluminum coated steel fin is standard for steam coil.

5.02.01 Fin's density can be from 8 FPI up-to 14 FPI

5.02.03 Fins shall be a collar type; assembled with ½" OD copper tubes (steel fins and steel tube for steam coils) and mechanically bonded to copper tube for greater heat transfer coefficient.

## Part-5 Water & DX Coil Section

### 5.02 Coil Construction

5.02.04 Coil Frames are made from galvanized steel and painted for additional protection.

5.02.05 Coil assembly shall sit within coil section face area and seal to the casing wall to avoid air by-pass.

5.02.06 Water coil - headers are made from seamless copper pipe and extended to outside pipe connection with threaded end (11 TPI) steel tube.

5.02.07 DX coil headers shall be all copper tubes with sweat connection type.

5.02.08 Coils shall be "counter" flow and equipped with vent and drain (drain and vent - water coil only).

5.02.09 Coils shall be tested at 300-psig submerged under water; designed to operate up to 230 psig (16 Bar) at 200°F (93°C).

5.02.10 Extended header connections out side the coil section shall be protected with metal shield to avoid any damage during transportation.

### 5.03 Condensate Drain Pan

5.03.01 Drain pan shall be mounted in slanted angle for complete and positive drainage.

5.03.02 Drain connection shall be at one sided of the drain pan.

5.03.03 Drain pan shall be from galvanized steel and internally coated with corrosion resistance elastic black asphalt; complies with NFPA 90 A for flame spread and smoke generation.

5.03.04 Bottom of the drain pan shall be insulated to avoid condensation.

5.03.05 Stainless steel drain pan can be available alternative to galvanized steel.

5.03.06 Stacked coils with intermediate drain pan shall be assembled for a coil with fin height greater than 1397-mm.

5.03.07 Intermediate drain pan shall have an extended drain tube to guide condensate water from top drain pan to the lower drain pan. This shall avoid lower fin to clog with extensive condensate water.

### 5.04 Moisture Eliminator

5.04.01 Metallic eliminator shall be installed at down stream of the coil when ever face velocity approaching 2.5 m/s (2.3 m/s for fresh air coil at highly humid condition).

## Part-5 Water & DX Coil Section

### 5.05 Access Panel

5.02.01 Removable panel shall be assembled at coil section's casing wall.

5.05.02 Panels shall be bolted externally for air-tightness, easy removal and quick reassemble to facilitate access for servicing and maintenance.

## Part-6 Electric Heater Section

### 6.01 General

6.01.01 Electric heater shall be of the cartridge type.

6.01.02 Heaters shall be framed with a slide in-out track so that the complete assembly is removable.

### 6.02 Standard Electric Heater – Open Wire Type

6.02.01 Standard electric heater shall be from Open Wire Type.

6.02.02 Heating wire shall be of composition 80% Ni and 20% Cr.

6.02.03 Heater assembly, the basic components shall be include airflow switch, power & control terminal board, grounding lug and primary & secondary over load temperature sensor.

6.02.04 Components are assembled inside terminal box integrated with heating elements frame assembly.

6.02.05 Frames shall be from a heavy gauge (G16) galvanized steel frame.

### 6.03 Remote Control Panel (option)

6.03.01 Remote Control Panel shall include basic components such as a de-energizing magnetic control contactor per stage or each 48 AMP circuit within a stage, a magnetic back-up contactor for each 48AMP circuit, power & control terminal board, grounding lug and high & low voltage terminal boards.

6.03.02 Control Panel's box shall be made from painted galvanized steel and weatherproof construction.

### 6.04 Closed Finned Heater Type (option)

6.04.01 Heating element is made of composition 80% Ni and 20% Cr.

6.04.02 Assembly of the heating element is secured inside the stainless steel spherical sheathed fins copper tube.

6.04.03 Heating component is according to AISI 321 and AISI 430.

## Part-6 Electric Heater Section

### 6.04 Closed Finned Heater Type - (option)

6.04.05 Heating elements are wired in star or delta according to the power supply and pre wired to the terminal block in the wiring box.

6.04.06 Safety thermostat (rating at 16 (2) A / 380 V ) with a 98 °C ( +0/-16 °C ) cut out is supplied and it is manually reset. Heating elements are mounted to a heavy gauge (G16) galvanized steel frame.

### 6.05 Access Panel

6.05.01 Totally removable panel shall be assembled at both casing wall and bolted externally for air-tightness, easy remove and reassemble panel to facilitate access for servicing and maintenance.

## Part-7 Fan And Drive Section

### 7.01 General

7.01.01 Fan shall be forward, backward and airfoil curved, double inlet and double width (DIDW) centrifugal type.

7.01.02 Fan performance shall be rated in accordance to DIN 24 163 (Fans Performance Testing, Standardized Test Airways) in reference to AMCA Standard 210-99.

7.01.03 Sound level shall be rated in accordance to DIN 45635 Part 38 " Noise Measurement of Machine: Fan" in reference to AMCA Standard 300-96.

### 7.02 Fan Construction

7.02.01 Blades of the fans shall be from galvanized steel.

7.02.02 Backward and airfoil fan's blades shall be treated with epoxy paint.

7.02.03 Wheel shall be statically and dynamically balance within fan operating speed in compliance to DIN ISO Standard 1940.

7.02.04 Standard fan bearings are "eccentric clamp bearing" type, single row ball bearing, mounted in pressed steel housing, pre-lubricated and sealed for life.

7.02.05 Reinforced fan bearings are "self-aligning double rows ball bearing", mounted in cast iron housing and re-grease able.

7.02.06 Bearing's nominal life expectancy shall be 40,000 $L_{10}$ operating hours (according to DIN ISO 281 Section 1). Rated bearing life can reach up to 200,000 $L_{10}$ hours.

## Part-7 Fan And Drive Section

### 7.02 Fan Construction

7.02.07 For VAV application, Inlet Guide Vane (IGV) can be available for backward and aerofoil fan; fan size range from 400 to 1000 (option).

7.02.08 Fan window and fan drainage valve can be available (option).

### 7.03 Fan Motor

7.03.01 Design and performance shall be according to IEC Standards.

7.03.02 Fan motor shall be suitable to operate with Variable Frequency Drive (VFD) or Frequency Inverter (FI).

7.03.03 Standard fan's motor shall be a Totally Enclosed Fan Cooled type (TEFC).

7.03.04 Motor's frame shall be from aluminum or cast iron.

7.03.05 "Index of Protection, shall be with IP 55; motor shall be protected against dust and protected against jets of water from all direction.

7.03.06 Insulation Class F ($T_{max}$ 155 $^{o}$C) and Temperature Rise Class B ($\Delta$T 80K).

7.03.07 Motor shall able to operate at 50°C operating temperature.

7.03.08 Motor shall have a thermal reserve to spare for overheating when induced by voltage fluctuation at ±10%; compliance to IEC 34-1.

7.03.08 Thermal Overload Protection "Normally Closed Thermostat" (PTO) shall be a standard accessory.

Note: PTO shall provide general surveillance for non-transient overload. Bi-metallic strip with normally closed contact is indirectly heated when line current passes through the strip and shall shut down or restores supply circuits as necessary. PTO connection shall be mounted to control circuit and suitable for manual or automatic reset.

7.03.09 "Positive Temperature Coefficient" thermistor (PTC) shall provide general surveillance for transient overload and shall be mounted and connected to a relay in control circuit (option).

### 7.04 Fan And Motor Mounting Frame (FMB)

7.04.01 Fan and motor shall be installed on a common base frame.

7.04.02 FMB shall be fabricated from heavy gauge galvanized steel or cast iron steel.

## Part-7 Fan And Drive Section

### 7.04 Fan And Motor Mounting Frame (FMB)

7.04.03 Motor rail shall be a slide rail type for flexible belt tensioning.

7.04.04 FMB shall be isolated from floor panel with anti-vibration rubber isolators (spring isolator as option)

7.04.05 Fan shall be isolated to discharge panel with flexible fan connection.

### 7.05 Pulleys And Belts

7.05.01 Fan drive package shall consist of fan and motor pulleys and assembled with Wedge belts.

7.05.02 Variable pitch pulley shall be available at motor drive up to 15 HP (11 kW) - option.

### 7.06 Access Door

7.06.01 Fan Section access shall be with hard nylon hinges and metal lock, accessible internally and externally for safety release.

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### Nomenclatures

| | |
|---|---|
| ACF | Activated Carbon Filter |
| AHU | Air Handling Unit |
| AMCA | Air Movement And Control Association Int. Inc. |
| ANSI | American National Standards Institute |
| ARI | Air-Conditioning & Refrigeration Institute |
| ASHRAE | American Society of Heating, Refrigerating And Air-Conditioning Engineers, Inc. |
| ASQC | American Society For Quality Control |
| ASTM | American Standardization Testing Material |
| CMH | Cubic Meter Per Hour |
| CWC | Chilled Water Cooled |
| DIDW | Double Intake Double Width |
| DIN | Deutscher International Norms |
| DOP | Dioctylphthalate |
| DSC | Double Skin Casing |
| DXC | Direct Expansion Coil |
| EHTR | Electric Heater |
| EN | European Committee for Standardization |
| FMB | Fan & Motor Base |
| FPI | Fin Per Inch |
| HEPA | High Efficiency Particulate Air |
| HPE | Heat Pipe Exchanger |
| HPLE | Heat Plate Exchanger |
| HWC | Hot Water Coil |
| HWE | Heat Wheel Exchanger |
| IAQ | Indoor Air Quality |
| IEC | International Electrotechnical Commission |
| IGV | Inlet Guide Vane |
| IP 55 | Index Of protection 55 |
| ISO | International Standards Organization |
| NEC | National Electric Code |
| OD | Outside Diameter |
| RAC | Run Around Coils |
| STC | Steam Coil |
| STH | Steam Humidifier |
| STL | Sand Trap Louver |
| SW | Spray Washer Humidifier |
| TEFC | Totally Enclosed Fan Cooled |
| UL | Underwriters Laboratory |
| VAV | Variable Air Volume |
| VFD | Variable Frequency Drive |

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# Selection Tools and Sample Selection

Following is an example of an AHU selection by utilizing some of the tools made available such as *Carrier* Flexair Software, Psychrometric chart and a fan curve.

**STEP 1: AHU Requirements**

All parameters and detail specifications needed for selection can be obtained from unit application, customer requirements or consultant guidelines. Such information is the key and basis of an AHU selection. Example of required inputs are as follows,

a. Panel thickness of 25mm double skin externally painted

b. EU7 soft bag filtration mounted on existing frame with prefilter

c. 2 steps 30kW heating capacity electric battery heater

d. Cooling requirements,
   i. total capacity: 72.8 kW
   ii. air on condition: 29°C / 47%
   iii. air off condition: 13.1°C / 98%
   iv. water entering temperature: 7.2°C
   v. water temperature rise: 5.6°C
   vi. airflow: 9612 $m^3$/hr
   vii. face velocity: 2.6 m/s

e. Forward curve fan with horizontal discharge

f. Motor service factor of 1.33

g. Adjustable pulley drive type

**STEP 2: Flexair Selection**

From adequate information given above, the Flexair Selection software can be made use of to enhance the AHU selection effectively. The software will assist in the AHU component selection section by section until the whole complete unit is done. In each section several options of component can be choose from to give flexibility in the selection while maintaining the AHU specifications.

A summary printout of the complete unit is readily available with sketch detailing the component layout for easy reference makes the software a powerful tool for Sales and Application Engineers. For more information on Flexair please contact your nearest *Carrier* office.

**STEP 3: Performance Checks**

To justify whether a good selection has been made, especially on airside, a quick double check can be performed by using a fan curve. The operating point of the selected fan can be plotted on its fan curve to ensure the selected fan is operating in a safe region where the performance of the fan is at its optimal.

Another tool that can be made use of is the Psychrometric Chart. The airside performance of the cooling coil can be plotted on the chart where the quality of air before and after the cooling coil could be determined. The two operating points (coil on-off conditions) would also determine the total, sensible and latent cooling of the air passing through the coil.

**STEP 4: Finalizing Selection and Placing Order**

Once the selection has been finalized, an order can be placed by filling the Order Entry Data List Mandatory form along with a copy of the Flexair summary printout.

**Flexair Summary Printout Example**

Carrier

## CARRIER 39F AHU- SPECS & DATA

| | | | |
|---|---|---|---|
| Customer : | Sample | Sales Engineer : | Azam |
| Job : | PD | Date : | 09/04/00 |
| Unit index : | SAMPLE | Flex-air version 4.3 SA | |

## Air Handling Unit model 39FD 350

### MIXING SECTION

Length = 2 module(s)
Air pressure drop = 6 Pa

| | Fresh air | Return air |
|---|---|---|
| Position : | Front | Top |
| Section (H x L) : | 498 mm x 1443 mm | 498 mm x 1443 mm |
| Airflow : | 1922.4 m3/h | 7689.6 m3/h |

### FILTER

Length = 2 module(s)
Air pressure drop = 213 Pa

| | |
|---|---|
| Type : | Soft bag filter |
| Efficiency : | 85% opacimetric / EU 7 |
| Mounting : | Existing frame access |
| Included : | Prefilter |

*(based on a clogging factor of 20 %)*

### ELECTRIC HEATER BATTERY

Length = 1 module(s)
Air pressure drop = 77 Pa

| Configuration | | Performance | | Fluid conditions | |
|---|---|---|---|---|---|
| Nb of steps : | 2 | Capacity : | 30 kW | Air On cond. : | 0.0°C / 50% |
| Supply voltage : | 380 V | Airflow : | 9612 m3/h | Air Off cond. : | 9.2°C / 26% |
| 1 anti-radiation screen | | Coil Face Velocity : | 2.54 m/s | | |

### COOLING WATER COIL

Length = 2 module(s)
Air pressure drop = 165 Pa

| Configuration | | Performance | | Fluid conditions | |
|---|---|---|---|---|---|
| Nb of rows : | 6 | Air On cond. : | 29.0°C / 47% | Glycol : | 0 % |
| Nb of circuits : | 24 | Air Off cond. : | 13.1°C / 98% | Water On T. : | 7.2°C |
| Fin spacing : | 2.3 mm | Airflow : | 9612 m3/h | Fluid flow : | 11.2 m3/h |
| Tube pitch : | Stag. 1/2 | Total capacity : | 72.8 kW | Coil Delta T : | 5.6°C |
| Material : | Cu/Al | Sensible cap. : | 52 kW | | |
| | | Coil Face Velocity : | 2.60 m/s | Delta P / water : | 18 kPa |
| | | Max. capacity : | 72.8 kW | Kv coil : | 26.4 |

Standard drip tray



AHU size

Module size for component

Section pressure drop

Component performance

Physical description

Carrier

## Air Handling Unit model 39FD 350

Unit index : SAMPLE  Date : 09/04/00  Flex-air version 4.3 SA

Component description

### FAN

Length = 4 module

| Fan data | | Motor data | | Performance | |
|---|---|---|---|---|---|
| Type : | Forward | Motor power : | 7.5 kW | Airflow : | 9612 m3/h |
| Size : | A 315 S | | | Ext. stat . press. : | 400 Pa |
| Discharge : | horizontal | Number of poles : | 4 poles | Unit Delta P : | 461 Pa |
| Speed : | 1463 rpm | Service factor * : | 1.33 | Velocity press. : | 161 Pa |
| Efficiency : | 60 % | | | Total pressure : | 1022 Pa |
| Shaft power : | 4.6 kW | (*) : Motor available service factor, | | | |
| Max. speed : | 2100 rpm | after deduction of drive loss. | | | |

*Acoustic data*

| dBA/Hz : | 63 | 125 | 250 | 500 | 1 k | 2 k | 4 k | 8 k | Overall |
|---|---|---|---|---|---|---|---|---|---|
| Fan Lw : | 60 | 72 | 78 | 81 | 84 | 83 | 82 | 75 | 90 |
| AHU Lw : | 59 | 70 | 72 | 73 | 75 | 70 | 62 | 52 | 80 |
| Lp * : | 48 | 59 | 61 | 62 | 64 | 59 | 51 | 41 | 69 |

(*) Acoustic pressure computed at 1.0 m, in free field space.

Fan flexible connection supplied in standard.

Access orientation

### CASING AND GENERAL OPTIONS

| | | | |
|---|---|---|---|
| Insulation : | 25 mm fiberglass 32 kg/m3 | | Right access |
| Casing type : | Double skin | | |
| Casing thickness : | 25 mm | | |
| Finish : | external casing painted | | IP55 light(s) |
| Colour : | light grey RAL 7035 | | |

### GENERAL DATA

| | | | |
|---|---|---|---|
| Altitude : | 0 m | Air around unit : | 20°C / 50% |
| Supply fan air on : | 20°C | | |

### WEIGHT AND DIMENSIONS

Unit physical information for reference

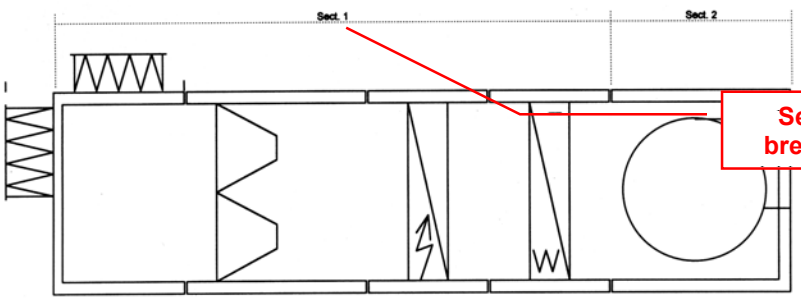
| | Total | Sect. 1 | Sect. 2 |
|---|---|---|---|
| Width : | 1.625 m | | |
| Height : | 0.995 m | | |
| Length : | 3.565 m | 2.205 m | 1.260 m |
| Weight : | 686 kg | 449 kg | 237 kg |

Weights do not include coils and humidifiers water.
Dimensions do not include dampers, connections, and accessories like frame, roof, etc...

Carrier

## Air Handling Unit model 39FD 350

Unit index : SAMPLE  Date : 09/04/00  Flex-air version 4.3 SA




Sections breakdown

Component layout

To customer : when ordering, please confirm on this drawing the connection side of each component, and windows side (in relation with air flow direction).

### WEIGHT AND DIMENSIONS

| | Total | Sect. 1 | Sect. 2 |
|---|---|---|---|
| Width : | 1.625 m | | |
| Height : | 0.995 m | | |
| Length : | 3.565 m | 2.205 m | 1.260 m |
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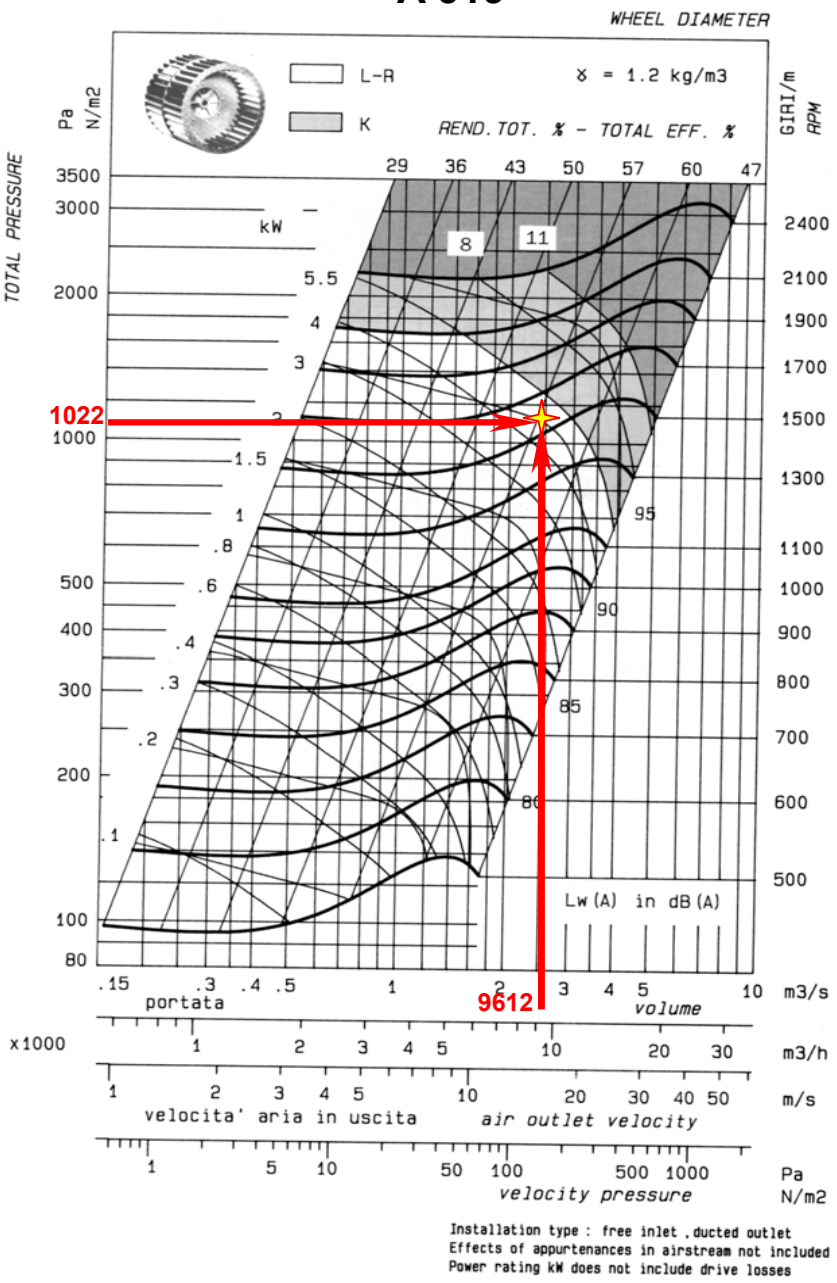
Page 3/3



## A 315



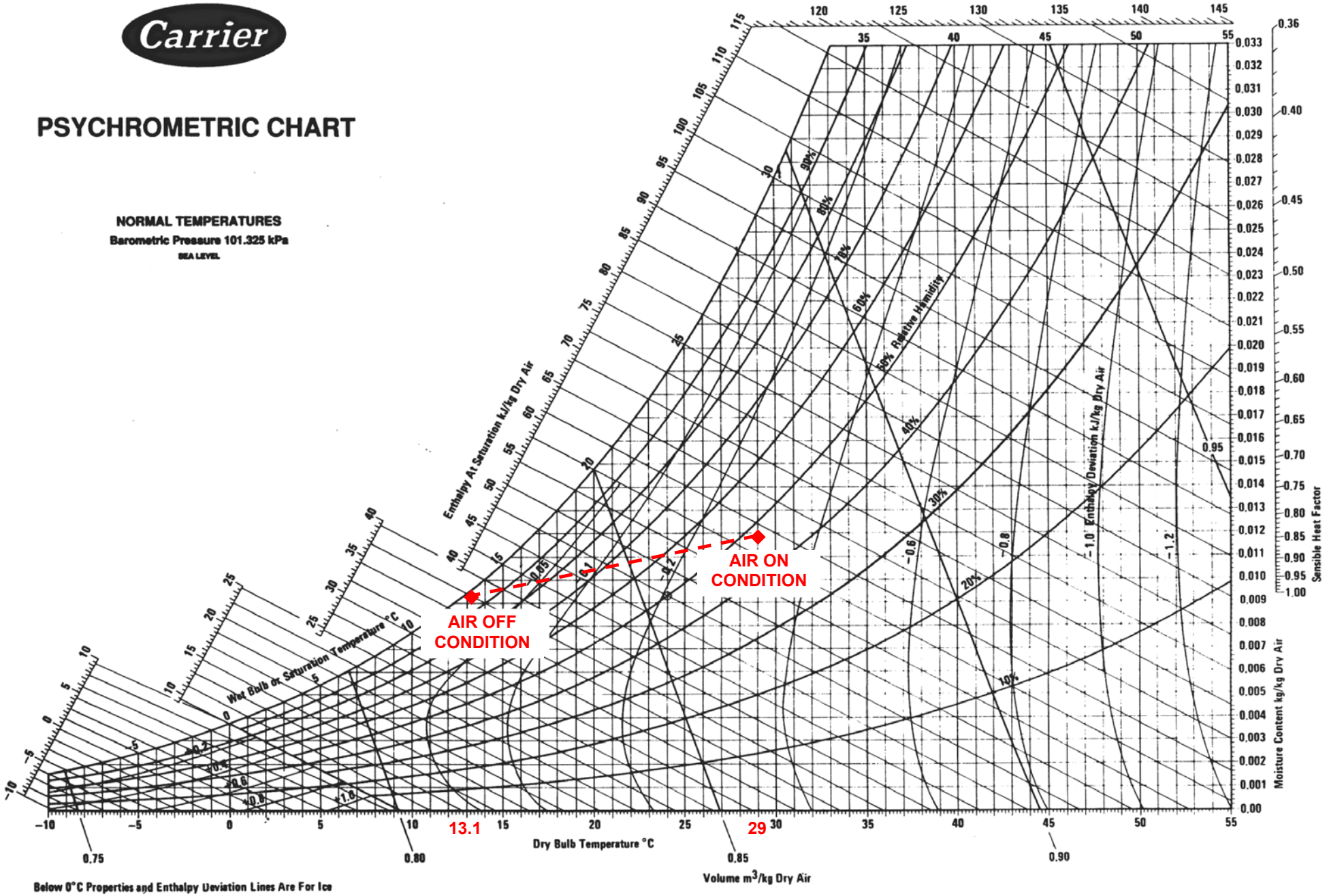
Carrier

# PSYCHROMETRIC CHART

**NORMAL TEMPERATURES**

**Barometric Pressure 101.325 kPa**

**SEA LEVEL**


AIR OFF CONDITION
AIR ON CONDITION
13.1
29
Dry Bulb Temperature °C
Wet Bulb or Saturation Temperature °C
Enthalpy At Saturation kJ/kg Dry Air
Moisture Content kg/kg Dry Air
Sensible Heat Factor
Volume m³/kg Dry Air
Below 0°C Properties and Enthalpy Deviation Lines Are For Ice

# 39F - ORDER ENTRY DATA LIST MANDATORY

**When placing an order, please ensure that the following data are properly specified. This would enable us to serve you better and avoid any delay and to avoid potential error in processing your order.**

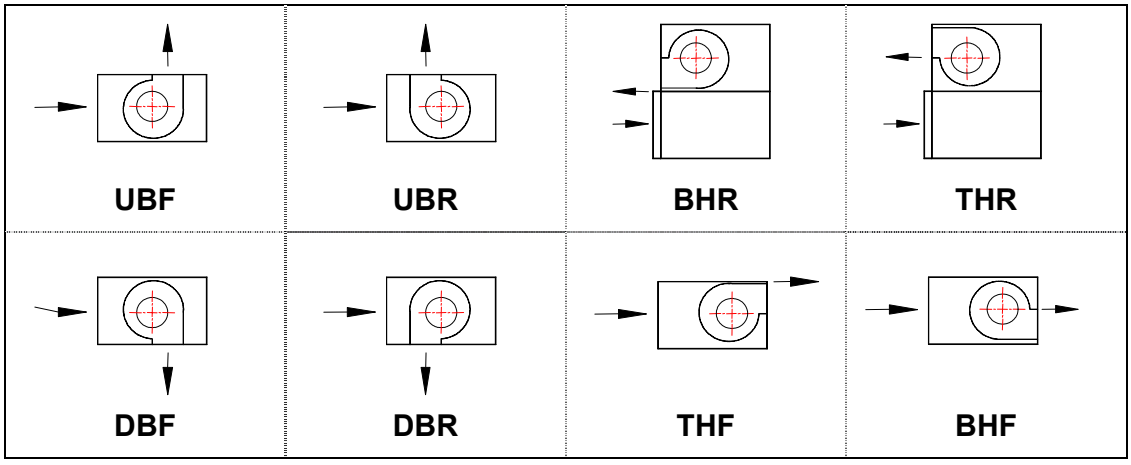
**ORDER NO.** _____

(PLEASE FILL IN THE TABLE STATING THE SIDE OF SERVICE)

| No | AHU Index | 39F Model | 39F Size | Qty | Coil Headers | Fan Section Access | Filter Section Access | Fan Discharge | Side Damper |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |
| 4 | | | | | | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |

Notes:

1 Side of Service reference is by looking the 39F AHUs in the same direction or the airflow.
2 Side of Service for fan, motor and drive set is same as per the Fan Section Access Door.
3 Please indicate RH=Right Hand Side or LH=Left Hand Side when filling the above table.
4 Fan Discharge Configuration, please refer to below sketch and indicate the discharge configuration in the above table (in the Fan Discharge Configuration column).




*Fan arrangement*

5 PLEASE SPECIFY POWER SUPPLY : _____ VOLT/_____PH/_____HZ

6 Please state any special option and/or instruction (if any). Use additional sheet if require.

_____

_____

# Conversion Table

| From | To | | Multiply by |
|---|---|---|---|
| **LENGTH** | | | |
| inches | millimeters | mm | 25.4 |
| feet | meters | m | 0.3048 |
| yards | meters | m | 0.9144 |
| miles | kilometers | km | 1.609 |
| **AREA** | | | |
| Square inches | square millimeters | $mm^2$ | 654.2 |
| Square feet | square meters | $m^2$ | 0.0929 |
| Square yards | square meters | $m^2$ | 0.8361 |
| **VOLUME** | | | |
| Cubic feet | cubic meters | $m^3$ | 0.0283 |
| Cubic yards | cubic meters | $m^3$ | 0.7646 |
| Quarts | liters | l | 0.9464 |
| US Gallons | liters | l | 3.7854 |
| Cubic centimeters | milliliters | ml | 1 |
| **MASS** | | | |
| Pounds | kilograms | kg | 0.4536 |
| Metric ton (2000lb) | tons (1000kg) | t | 0.907 |
| US ton (2240lb) | tons (1000kg) | t | 1.016 |
| **TEMPERATURE** | | | |
| °F | °C | °C | (°F-32)÷1.8 |
| °C | °F | °F | (°C x 1.8)+32 |
| °C | Kelvin | K | °C + 273.15 |
| **ENERGY** | | | |
| BTU | kilojoules | kj | 1.055 |
| Kilowatt-hour | kilojoules | kj | 3600 |
| **POWER** | | | |
| Horsepower | kilowatts | kW | 0.746 |
| **HEAT FLOW** | | | |
| BTU/hr | watts | W | 0.2931 |
| BTU/hr | kilocalories/hr | kcal/hr | 0.2519 |
| Tons (refrigeration) | kilowatts | kW | 3.517 |
| Tons (refrigeration) | kilocalories/hr | kcal/hr | 3024 |
| **HEAT TRANSFER COEFFICIENT** | | | |
| $BTU/hr/ft^2/°F$ | $watts/m^2/°C$ | $W/m^2/°C$ | 5.678 |
| $kcal/hr/m^2/°C$ | $watts/m^2/°C$ | $W/m^2/°C$ | 1.163 |
| **VOLUME FLOW** | | | |
| CFM | cubic meter/sec | $m^3/s$ | 0.000472 |
| CFM | liter/sec | l/s | 0.472 |
| CFM | cubic meter/hour | $m^3/hr$ | 1.699 |
| GPM (US) | liter/sec | l/s | 0.0631 |
| GPM (Imperial) | liter/sec | l/s | 0.0757 |
| $m^3/hr$ | liter/sec | l/s | 0.2778 |
| **VELOCITY** | | | |
| FPM | meter/sec | m/s | 0.0051 |
| **PRESSURE** | | | |
| in.of water (iwg) | kilopascal ($kN/m^2$) | kPa | 0.249 |
| ft of water ($H_2O$) | kilopascal | kPa | 2.99 |
| Pounds/sq.in (psi) | kilopascal | kPa | 6.895 |
| Pounds/sq.in (psi) | kilogram/sq.centimeter | $kg/cm^2$ | 0.0703 |
| ft of water ($H_2O$) | bar | bar | 0.03 |
| Pounds/sq.in (psi) | bar | bar | 0.0693 |

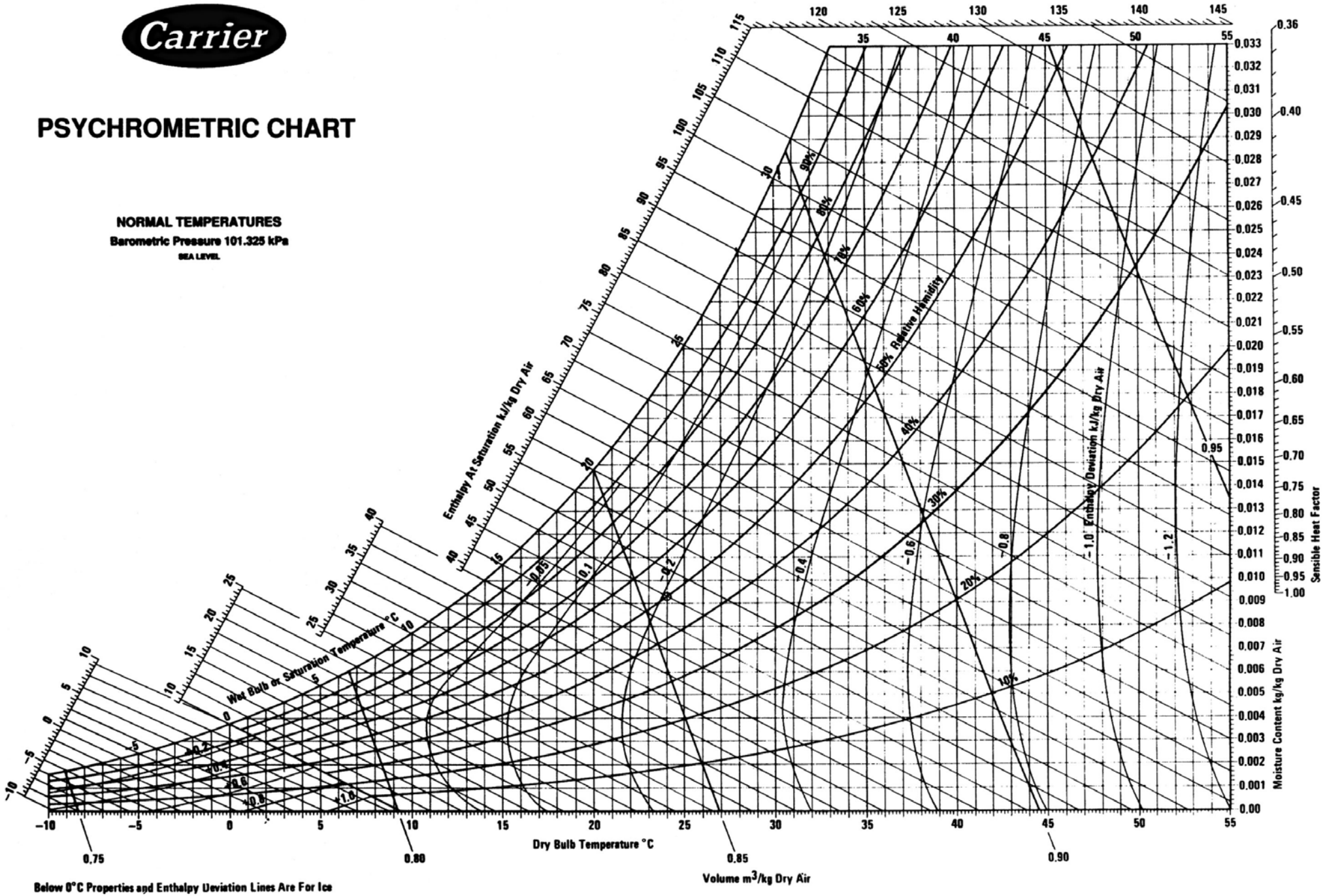
Carrier

# PSYCHROMETRIC CHART

**NORMAL TEMPERATURES**

**Barometric Pressure 101.325 kPa**

**SEA LEVEL**




Below 0°C Properties and Enthalpy Deviation Lines Are For Ice

# Notes